MAY 1 2 19

The ELECTRICAL REVIEW

FOUNDED 1872

VOL. XCIV. No. 2422. | [All Rights Reserved.] | APRIL 25, 1924. | [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] | PRICE SIXPENCE.

LITHOLITE INSULATORS, Ltd.
55–57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES.
ESTABLISHED 20 YEARS.

SHEET ELECTRIC INSULATION, MOULDINGS
NON-HYGROSCOPIC, FIREPROOF.
SILUMINITE
The SILUMINITE INSULATOR Co., Ltd.
THE GREEN, SOUTHALL, MDLX.
'Phone and 'Gram: SOUTHALL 59.

FERGUSON, PAILIN, Ltd.
SPECIALISTS IN
SWITCHGEAR.
HIGHER OPENSHAW, MANCHESTER.
'Phone: OPENSHAW, 329. 'Grams: TENSION, MANCHESTER.

RESISTANCE MATERIALS
Asbestos Woven Resistance Grids. Resistance Cord. Resistance Wires & Tapes.
CRESSALL MANUFACTURING CO.,
Staniforth Street, BIRMINGHAM.
Telegrams: "Ohmic, Birmingham." Telephone: Central 3463.

INSTRUMENTS, CIRCUIT-BREAKERS,
AUTO-CUT-IN & CUT-OUTS
THE **Record Electrical Co.,** Ltd.
BROADHEATH, MANCHESTER.
TELEPHONE: 164 ALTRINCHAM.

"HEATRAE" Registered.
ELECTRIC FIRES, Ltd., NORWICH.
See Page iii. next week.

SWITCHGEAR
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON.

"CANTIE"
IRONCLAD SWITCHBOARDS
CHEAP, EFFICIENT, ROBUST.
CANTIE SWITCH CO., LTD.,
LEIGHTON ST. NOTTINGHAM.

SAXONIA EST. 1895.
ELECTRICAL WIRE CO., LTD.
GREENWICH, S.E. 10.
British Make.
EXTRA FLEXIBLE CABLES AND CORDS.
DYNAMO AND TRAILING LEADS.
AERIALS FOR WIRELESS.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

Cutting
Electric Motors.
CUTTING BROS., LTD., STAMFORD.
Telegrams: Cutting, Stamford. Tel. No. 12.

"EMPIRE"
AUTOMATIC CONTROL.
AVENUE 14 BRITISH EMPIRE EXHIBITION BAY 8
ELECTRIC CONTROL, Ld., GLASGOW.

A.C. & D.C. MOTORS REWOUND TO SUIT ALTERATIONS OF SUPPLY.
REWINDS
Estab. 15 years.
BURDETTE & Co. Ltd. Pocock St., LONDON, S.E.1.
Hop. 4572 3953.
Trade Enquiries Specially Invited.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Connaught House, Aldwych, W.C. 2.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement this week, p. xviii.

A. MARTELLI
6, Little Newport St., Charing Cross Rd., W.C. 2.
LARGEST STOCK in the World of Italian
ALABASTER BOWLS.
Carved Bowls and Brown-Veined Plain Bowls at only 25% more than Plain Grey-Veined.
ASK FOR BEAUTIFULLY ILLUSTRATED PRICE LIST.
Gerrard 2901 *Cables: "Agalma, London."*

CAST-IRON
ELECTRICAL RESISTANCE GRIDS
OF
GUARANTEED RESISTANCE.
Catalogue dealing with over 40 Standard Designs on application.
ED. MATTHEWS, Ltd., BILSTON, STAFFS.

E. DAWSON & CO.,
LAMPS (AS USUAL),
In addition
Wireless Valves, Crystal and Valve Receiving Sets, Head 'Phones, &c.
10, Gray's Inn Road, London, W.C. 1.
(Phone: Holborn 2794.)

JULIUS SAX
Specialists in
BELLS
and
Wall Plugs.
24a, High Street, Bloomsbury, W.C.2.

Wembley-wards.
See Sup. 9.

MOTORS
BY
McClure & Whitfield,
Small Power Dynamo Co., Ltd.
Agents
CITY ELECTRICAL CO., 1, Emerald Street, LONDON, W.C. 1.

VINCENT
Important— *See page v.*

ALUMINIUM for BATTERY CONNECTIONS.
The British Aluminium Co., Ltd., 109, Queen Victoria St., London.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

CURTIS MFG. CO.
CONDUIT PLACE, PADDINGTON, LONDON, W. 2.
RESISTANCES and CHARGING BOARDS.
OF CONSTANT RATING FOR
ALL PURPOSES.

For Everything Electrical use
BIRKBY'S "ELO" INSULATION
Mouldings, Moulding Powders and Varnish.
High Dielectric and Mechanical Strength.
BIRKBYS, Liversedge, Yorkshire.

FULLER'S UNITED ELECTRIC WORKS, LIMITED.
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES EBONITE
WIRELESS APPARATUS CARBON BLACK
Head Office:
(General Sales Offices and Works).
WOODLAND WORKS, GROVE ROAD,
CHADWELL HEATH, ESSEX.

Raising the Standard Another Notch.
M.E.M.
See p. xl.

Advertisement Index see page xl. *Official Notices see Sup. 36.*

Individuality

is a characteristic of each Sterling Insulating Varnish. Of the thirty-two made there is one which satisfies your demands. Ask us about it.

CATALOGUE.
The Sterling Catalogue describes in detail each Sterling Varnish, its use and procedure.
Your request for information will bring a copy of the catalogue also.

The Sterling VARNISH COMPANY
Royal London Buildings
196, Deansgate, Manchester

MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE—2381 HOLBORN.
TELEGRAMS—"MICAYLOR, LONDON."
TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C. 1.
(The Oldest Established Mica House in the Country.)
AND ALL BRITISH.

THE ORIGINAL COMMUTATOR GRINDING BLOCK.

The **ONLY** BRITISH MADE BLOCK ON THE MARKET.
— ***Cheapest and Best.*** —

Commutator Blocks 4" to 30" dia.
Slip-Ring Blocks 12" to 30" dia.

PRICES: 6/- to 17/6

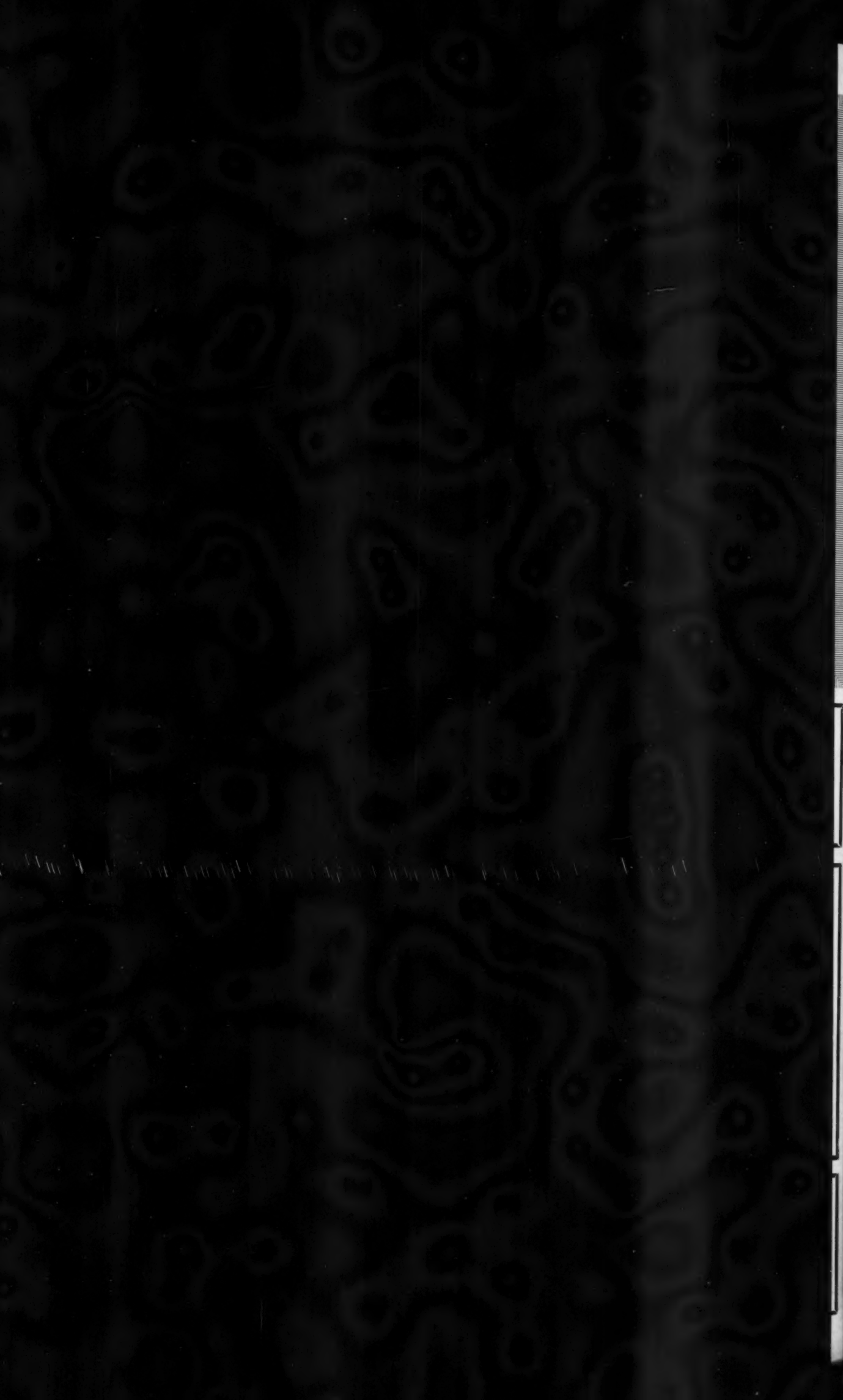
All Standard Sizes in Stock. *Special Sizes to Order.*

The COMMUTATOR GRINDING BLOCK Co.
16, WEST BLACKHALL STREET, GREENOCK.
Telegrams: "Grinding, Greenock." Telephone: 776 Greenock.

SOLE LONDON AGENTS:
COLLINS ELECTRICAL LIMITED,
115, CLERKENWELL ROAD, LONDON, E.C.1.
Telegrams: "Colarmairs, Holborn, London." Telephone: Holborn, 213 & 218.

RESISTANCES.

If it's a Resistance you want,
——Remember that Austin Walters & Son make it.
AUSTIN WALTERS & SON, Gaythorn Electric Works, MANCHESTER.



The

Electrical Review

VOL. XCIV. APRIL 25, 1924. No. 2,422.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEKKAY, CENT., LONDON," Code, A B C. Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

LIST OF FOREIGN AGENTS (see first page "Official Notices").

Contents:

	PAGE
British Trade Literature for Abroad	641
The British Empire Exhibition	642
French Railway Electrification	642
The E.D.A. Salesmanship Conferences	643
The Faraday Medal	643
Telephony Throughout Europe	643
Electrical Work in Italy	643
Some Factors in Agency Negotiations, by A. J. Smith	644
Overhead Electric Power Transmission, by William T. Taylor	646
Notes from Canada	648
New Electrical Devices, Fittings, and Plant (*Illus.*)	649
The Turbine Breakdown at the Shanghai Electricity Works	650
Parliamentary	650
Legal	651
Correspondence—	
Employment in Australia	652
Service Charges	652
The Late Mr. George Hookham	652
The Bellini-Tosi Radio Direction Finder	652
Squirrel-cage Motors of over 5 h.p.	652
The a.c. Commutator Motor and the Engineer's Education	652
The National Register of Electrical Installation Contractors	652
Radio Valves	653
A Transmission-line Problem	653
Business Notes	653
Lighting and Power Notes	656
Tramway and Railway Notes	657
Telegraph and Telephone Notes	657
Radio Notes	658
Contracts Open and Closed	658
The Calcutta Electricity Supply Undertaking, by W. Twinch (*Illus.*)	659
Forthcoming Events	664
Notes	664
Institution Notes	665
Our Personal Column	666
New Companies Registered	667
Official Returns of Electrical Companies	667
City Notes	667
Stocks and Shares	669
Power-circuit Interference with Telegraphs and Telephones, by S. C. Bartholomew (*Illus.*) (*concluded*)	671
New Salvage Works at Birmingham	673
The Electrical and Engineering Exhibits at Wembley (*concluded*)	673
Selling Electric Power	674
Exports and Imports of Electrical Goods and Machinery in March, 1924	675
The New Italy	675
The Building Exhibition (*Illus.*)	677
A 135,000-volt Outdoor Oil Circuit Breaker (*Illus.*)	678
Reviews	679
Published Specifications	680
Contractors' Column	Advertisement page xxviii

British Trade Literature for Abroad.

"We are flooded with American catalogues, but the British, which are most needed, are never available."

WE quote the above S.O.S. message from a letter received from overseas. It emanates from a public official who has it in his power to give out orders for electrical and allied manufactures. His preference is for British products, but instead of British manufacturers and traders approaching him with particulars of their goods, he is bombarded by others with information which under some conditions may be an inducement to him to stifle his British sympathies.

It is obvious that price and the other oft-quoted difficulties are not the only things that hinder the revival of export trade. There is still absence of up-to-date information in certain overseas markets. The ELECTRICAL REVIEW is received and the potential buyer ascertains therefrom a good deal that he requires to know, but until manufacturers generally use advertising space with such liberality and regularity as to permit them to convey up-to-date particulars of individual products instead of being content with imparting a general impression, its full assistance will not be utilised. It is said of some advertisers that they do not utilise their space nearly as efficiently as they might do, and much might be written regarding opportunities missed by failing to give addresses of overseas branches or agencies to which buyers might apply, and so forth.

The reader of the trade Press learns from the advertising pages the names and addresses of manufacturers and traders who are able to provide, or to quote for, his requirements, but sometimes, as in the case of the potential purchaser whose criticism we quote, instead of writing to a number of firms, he writes home to the Editors asking them to let it be known that catalogues

and prices of certain goods are needed. This is a quite legitimate service that we can and do, with great satisfaction, render; but we cannot refrain from serious questioning regarding the completeness of the export trade equipment at some headquarters here.

Private mailing lists and trade paper circulation lists are far from being alike, for it must be recognised that there are thousands of overseas readers of the trade and technical journals whose names do not appear in directories or other customary lists of possible buyers, and to many of these catalogues and price particulars cannot be forwarded until they make themselves known, but such a remark cannot be applied to officials in charge of public departments. These surely are in quite another category. They are known, their names appear in the recognised records, and anybody who wants to approach them is at liberty to do so. Why, then, does it happen that such officials are neglected? We should have supposed that they of all people would receive traders' literature.

We are aware that the cost of printing is high and that postage rates are not low, but this circumstance is or should be less of a deterrent than it was a few years ago, and as there may not be a material fall, if any, for some time to come, it is worse than useless to allow fond anticipation to put a brake on enterprise. Varying price conditions may deter some firms from the production of complete catalogues, and even from the issue of much beyond small price lists which avowedly are subject to frequent changes, but from the publicity literature that is reaching us every day we do not think the weakness lies so much in lack of production as in incompleteness of distribution.

Two main conclusions we arrive at as the result of some of our recently-received correspondence. One is that co-operative measures for publicity abroad through groups of firms acting in concert through a separate organisation have not succeeded, the long-established facilities continuing to hold pride of place when efficiently utilised by separate businesses on their own behalf. The other is that some of what are commonly regarded as small, insignificant and even impossible territories or islands, for our traders, can be made to yield orders for British manufactories if they are adequately cultivated. There is a special attractiveness in writing about the big things that are happening in India, Africa, and Australia, and what should soon come to pass in Russia or other immense fields for trade activity, but we shall not do well to overlook the opportunities in the smaller and less imposing markets—the islands of the sea.

The British Empire Exhibition.

As these lines leave our hands, the British Empire Exhibition—the greatest of its kind ever held—is opening its doors, and for the next six months it will occupy a leading place in the thoughts and affairs of the nation; its influence will extend to every corner of the world, it will bring hundreds of thousands of visitors to our shores, and its effects upon our national welfare will be felt for many years. Coming some five years after the greatest war in history, at a moment when hope is reviving on all hands and the unparalleled depression which resulted from the war is slowly giving place to a spirit of renewed optimism and enterprise, the Exhibition could not have been better timed; it is, as has been well said, the show-window of the Empire, where all the products of that great society of nations in truly infinite variety are now displayed for all the world to see. That this magnificent show of British Empire goods will result in a powerful stimulus to trade and industry we fully believe, and we rejoice that British minds have conceived and British manufacturers throughout the Empire have whole-heartedly supported an enterprise unique in magnitude and importance, and most admirably adapted to its purpose.

As Lord Askwith has pointed out, the citizens of the Empire are themselves most directly interested in the Exhibition, which will show them what they can do for each other; as the Dominions are the best customers of the Homeland, so the latter can be and should be the best customer for the former. The Empire is complete in itself, and can produce everything that is required in any part of it; let us all, then, both at Home and in the British lands oversea, make a point of demanding "Empire goods only"; so shall we fulfil the most important object of this great undertaking.

From an electrical point of view the Exhibition will far excel all previous efforts, and will demonstrate the ability of our engineers to cope with any requirement that may arise. Not only in the size, range, and quality of standard products will it be noteworthy; in every department the exhibits will be marked by originality of conception and novelty of execution. The lighting of the exhibition, for instance, will be carried out on entirely new lines, as regards both the general illumination and the flood-lighting of the buildings. Electricity will transport visitors by road and rail to all parts of the exhibition, and the "Never-Stop" railway (may it justify its name!) is wholly unique. The domestic uses of electricity form the *motif* of a striking and convincing exhibit organised by the Electrical Development Association at a heavy cost, with the support of the supply undertakings of the country, and will also be exemplified on numerous individual stands. Amongst the heavier items will be found the Highfield "transverter," capable of producing direct current at 100,000 volts, regarding which little exact information has been made public; switchgear and transformers for pressures of the order of 135,000 volts; hydraulic turbines of large output; automatic sub-stations for railway supply, and electric railway locomotives; railless car equipment, &c. To describe all the electrical exhibits in detail would require volumes, and would not be appreciated by our readers, but we shall do our best to convey to them an adequate impression of the leading features and of the general character of each exhibit of electrical or allied interest, and to support the manufacturers who by their enterprise and foresight have done so much to ensure the success of the Exhibition, at very heavy cost to themselves. We hope that their efforts will be rewarded by a large and maintained influx of orders, and that this vast undertaking will thus go far towards solving that problem which weighs so heavily on the national conscience—the problem of unemployment.

French Railway Electrification.

According to the report for 1923 of the Compagnie du Chemin de Fer de Paris à Orleans, the work of electrification was further proceeded with last year, and 1924 should witness the inauguration of electrical services in the environs of Paris as far as Etampes and Dourdan. Further, the Ministry of Public Works has approved the work of electrification of the lines from Paris to Brive and to other sections which form part of the first programme. With regard to the progress of the works connected with the establishment of hydro-electric stations for the supply of energy, one of these stations will be started in 1925, one in 1926, and a third in 1927. Operations in connection with the erection of the high-pressure transmission lines at 90,000 volts and 150,000 volts are being pushed forward, as is also work on the construction of the sub-stations. Of the 80 motor-cars and 200 locomotives ordered in 1922 and now under construction, 100 of the locomotives are expected to be delivered before the end of this year. It has now been decided to raise loans amounting to 900,000,000 fr., of which 180,000,000 fr. represents electrification works in 1924 and the early part of 1925. The Compagnie des Chemins de Fer de Paris à Lyons et à la Mediterranée mentions in its recently-issued report that it will electrify in the first place the line Culoz-Modane, and secondly the line from Carnoules to Vintimille; the former will be completed next year. The sub-stations and the transmission lines are in course of execution, and orders have been placed for 34 electric locomotives for passenger service and for 30 locomotives for goods traffic.

Another company that also proceeded actively with railway electrification operations during 1923 is the Compagnie des Chemins de Fer du Midi. In the Ossau Valley the Hourat generating station was brought into service, and on the completed part of the 150,000-volt network, certain lines were working provisionally at 60,000 volts, pending the finishing of the transformer station. At present, the transmission of energy is taking place as far as Toulouse.

The E.D.A. Salesmanship Conferences.

Looking back on the salesmanship conferences of the E.D.A. during the 1924-25 session, one cannot deny that their interest and usefulness have extended. The interest which the conferences provoke cannot be better illustrated than by recalling the fact that early in the session it was found necessary to migrate from St. Bride's Institute to a larger hall at the London School of Economics. Not only is the increasing value of the conferences reflected in the larger attendances, but the discussions, which from the beginning were lively, have become increasingly so. There has, perhaps, been a tendency on one or two occasions to overlook the sales side of the problems discussed and to deal with their technical aspects, but this is sometimes difficult to avoid, having regard to the subjects under discussion. During the session there have been a few papers read in London by those engaged in selling electricity and electrical apparatus in the provinces, whilst Londoners have read papers at provincial conferences. This is all to the good, enabling, as it does, salesmen from all over the country to discuss their problems together, and Mr. Beauchamp (the director of the E.D.A.) is making arrangements for the extension of this policy in the future.

An option has been obtained on the hall at the London School of Economics for next session's conferences, the programme for which is well in hand, though Mr. Beauchamp would value any suggestions which those interested may care to make. Another idea, not yet fully worked out, is that some of the conferences might be held occasionally at places where something attractive might be seen, and where there was something to be learned apart from the conferences themselves. One of the valuable features of the conferences all along has been the bringing together of contractors, manufacturers, and representatives of supply authorities, who have discussed each other's difficulties and have had opportunities of appreciating them. At the same time, there are one or two well-known contractors whose faces were familiar at the London conferences, but whom we seem to have missed towards the end of this session, and we wonder if this is in any way connected with a suggestion made by Mr. Beauchamp that they are getting into the habit of reading the reports of the conferences in the electrical Press, and so getting the information they desire without attending the meetings. The E.D.A. is to be congratulated on the session's work. At the final meeting last Friday more than one speaker testified to the help which he had received from the conferences.

The Faraday Medal.

Last night the Faraday Medal of the Institution of Electrical Engineers was to be presented to Mr. S. Z. de Ferranti, D.Sc., a past-president of the Institution. The first award was made to Mr. Oliver Heaviside, a pioneer and extraordinarily fertile worker in electrical theory; the second was made to Sir Charles Parsons, F.R.S., whose invention of the steam turbine revolutionised steam practice throughout the world. The Institution has done well in adding to these illustrious names that of an engineer and inventor who has "rendered conspicuous service to the advancement of electrical science," for Dr. Ferranti led the world in the generation of electricity on the large scale, its transmission to a distance at extra-high-pressure, and its distribution through transformers. The electrical industry is under a deep obligation to him, and in conferring upon him the high distinction of the Faraday Medal, the Institution does honour also to itself.

Telephony Throughout Europe.

It is announced that a conference of telephone experts is to take place in Paris at the end of April to discuss the question of the establishment of a European telephone network. Among the countries participating is Germany, whose geographical situation renders that country of great importance as a transit land for telephone communication. In discussing this problem at a recent meeting of the World Economic Association in Berlin, Herr Craemer is reported to have stated that there was no longer any difficulty in covering all distances in Europe, from the Spanish coast to the Polar Sea, by means of the telephone. It was necessary for the overhead lines to be converted to underground cables in order to render communication reliable. Cable networks were also in existence, in course of construction, or projected in other European countries than Germany, and all these networks were to be supplemented by overhead lines in districts where there was but little traffic, and were to be combined into an all-European telephone network. The total length of this cable network on first establishment would amount to 14,880 miles, of which over 25 per cent. would devolve upon Germany. The special object of the Paris conference was to overcome the technical, organising, and financial difficulties arising from the combination of the networks of the different countries into a general European telephone network.

Electrical Work in Italy.

The triumphant confirmation in power of Signor Mussolini at the recent elections invites a consideration of the effect that the maintenance of Fascismo in Italy may have on British commercial relations with that country. Italy in proportion as her railway electrification programme is developed is a potential consumer of large quantities of generating plant, motors and traction material which this country technically is in an excellent position to supply. Commercially, however, the barriers of import duties and exchange rates have, since the war, prevented British electrical manufacturers from doing as much business with Italy as their reputation and experience in railway traction work warrant. Signor Mussolini is understood to be in favour of a moderately rather than a highly protective import tariff, particularly when the duties levied are likely to increase indirectly the cost of other articles. This policy has already found expression in the reduction of from 1 to 0.6 or 0.7 in the coefficient of increase applied to the tariff rates on most electrical material. At the same time, rebates, and in some cases, exemptions from duty are granted in respect of machinery required in connection with the establishment of new industries or important public works. There is some hope that this policy may be pursued further and give British firms an opportunity of increasing their supplies of material which the Italian electrical industry may not be able to furnish so advantageously, or expeditiously. The sterling rate for the lira is not so unfavourable to British trade as it was. The British Commercial Secretaries in Italy report that of the special types of electrical machinery not yet made in the country, the United States, Germany and Switzerland have principally supplied the need. These countries, it should be noted, have succeeded in introducing their goods, where Great Britain has largely failed, although they are in no more favourable position as regards import tariffs than we are. Further, while Germany has been able to practise "valuta" dumping in the past, she is unlikely to be able to continue in the future. In all the circumstances it may fairly be inferred that the Italian market is worthy of careful attention. Hydro-electric work and railway electrification are bound to progress, and large sums are likely to be spent on telephone work.

D

Some Factors in Agency Negotiations.

By A. J. SMITH.

The subject of agencies, and especially foreign agencies, is one which is worthy of a great deal more attention than it usually receives, especially when one considers that the biggest proportion of overseas trade in the electrical and heavy engineering industries is done under some form or other of agency system. The successes of many of our older established firms with most of their agencies are noteworthy achievements, but anyone whose business has brought him into intimate contact with the foreign agency arrangements of any considerable number of engineering firms must have marvelled at the hundreds upon hundreds of agencies which are in existence in different parts of the world (all complete with agency agreement duly stamped, signed, and witnessed!) through which not a pennyworth of business is being done, nor apparently ever will be done until the agreement expires.

In considering agencies or prospective agents, we may divide them roughly into two classes, namely, those who have already done business in the class of machinery for which they are seeking an agency, and those who have not. A man of the first class may possibly have become dissatisfied with the quality of the make he has been selling, with the deliveries, or with the price; but there are numbers of reasons why such a man may occasionally be seeking an agency, though it is seldom that one comes across him. But when an authentic buying agent of this type does turn up he is worth a hundred times as much as the one without experience, and the manufacturer will be well advised to spare no effort to comply with his idiosyncrasies. The negotiations will not follow the same easy course as with one of the second class; it may be taken for granted that they will be very difficult. The agent will probably know as much about the goods as the actual manufacturer, and as far as the commercial value of any selling points is concerned probably a good deal more; he knows to a shilling the precise point at which the sale of the goods will be automatically stopped by reason of competition, and, as regards the merits and demerits of similar goods by rival manufacturers, he will undoubtedly be better informed than the maker he is approaching. Negotiations, therefore, are bound to be difficult, and by the time the agency is concluded prices will probably be cut very fine; alterations here and there in the maker's designs will be wanted, those designs which have been the subject of so much study and the object of so much pride; but against all these stumbling-blocks in the negotiation stage, this type of agent has one supreme advantage: he knows what trade he can do under certain conditions, and it will be found in almost every case he is prepared to order for stock in return for a sole concession.

Contrast the difficulties of these negotiations with the smoothness and celerity with which it is possible to conclude an agency arrangement with the firm or the man who has not previously done business in the precise type of apparatus which the manufacturer is marketing. There is no quibbling in this case about prices or discounts, no awkward questions as to how it is possible to justify a certain price as against the figure charged for a better-known and more widely-advertised make with a much fuller equipment. Our manufacturer is pleasantly surprised to find that his standard prices and discounts (which he has most reluctantly had to modify for certain of his largest and keenest customers) are not rejected with scorn, but accepted as quite normal. Then on the question of design, there is no hint of alterations being required in the standard design, in fact, strange to say, the agent thinks there is undoubtedly an enormous business to be done in the apparatus offered—unqualified by any disturbing conditions as to alterations to patterns or the like—there is even a decided preference for goods of British manufacture, which, it appears, have a name for excellence of workmanship, &c.! It is true that on the question of ordering something for stock the agent takes an unexpected and firm (very firm) stand, but, obviously, as he so very reasonably explains, with a make which is totally unknown in his territory, he cannot be expected to say what can be sold until the market is thoroughly tried; but with his travellers, with his unequalled selling organisation throughout the territory, the fact that he is *persona grata* with every large buyer, and that the directorate of almost every firm of importance consults him and takes his advice when it has any important order to place—naturally, if there is any business whatever to be done, our good friend can scarcely fail to secure the lion's share, if not the lot! Dealing with such an excellent and sweetly reasonable man as our agent, and after a prologue of such promise, it seems almost indelicate to raise the curtain to follow the subsequent course of the agency. Instructive it may be, but there is little amusement in watching the steady downfall of those high hopes which were formed at its inception. In nine months' time the agent will have discovered that there is competition in this line. Fifteen months afterwards it will appear that there are certain countries with depreciated exchanges manufacturing the same class of article, and selling in that particular market. Eighteen months afterwards we shall learn that enormously extended terms of payment are absolutely necessary if any business whatever is to be done in this market—and so on! But why follow the sorry transaction any further?

After examining the history of a few score of these sterile agencies, one is tempted to ask why are they ever brought into being? In the first place, let us look at the matter from the agent's point of view, and consider why it is that anyone seeks an agency. In the case of the type of agent we have considered first of all, the reason is self-evident. He has an established *clientèle*; he depends upon the sale of a certain number of machines per annum for a certain portion of his turnover and for his profits, and if he has to give up the sale of one make, he must, obviously, seek another source of supply immediately. But there are certain other types of agent whose principal occupation seems to be the collection of agencies, quite undeterred by their total ignorance of the goods they seek to handle or of the business in them. These agencies are collected—not as some connoisseur builds up his collection of china of a certain period, or as a philatelist plans a collection of stamps, for such people work on some settled plan—but agencies are collected on the same lines as a boy collects marbles or as a savage amasses coloured beads, the sole end and aim being quantity. The class of goods would appear to be quite immaterial, as one reads through many of the applications which are received by manufacturers. The same man is quite willing to take an agency for typewriters and one for traction engines. Is there any reason behind this apparent absurdity?

Agency collecting upon these lines is a gamble in which the player (the collector) stands to lose nothing, and yet has a sporting chance of gaining an attractive prize. There is no entrance fee, because from this type of representative there is not the remotest chance of ever obtaining a definite order for stock (or even a meaningless "contract" for delivery as and when required) in return for a sole concession; as a matter of fact, the manufacturer will be pressed to send out machinery upon open consignment terms. The chances for the agent of a substantial prize are several. Just as in many manufacturing quarters there is a pathetic hope that they may some day secure the "born salesman"

who, in the midst of the most profound trade depression, will fill the works with orders at generous prices, so almost every agent cherishes the hope that he may by chance secure an article which "sells itself"—something which, by its superlative workmanship, by its amazing output, or by its wonderfully low price, will sell at sight! Such a thing is rare, but the belief in it is widespread, and the more agencies that are collected, naturally, the greater the chance of securing such a prize.

Another possible prize which is not to be despised, lies in publicity. The manufacturer with a new territory allocated and a persuasive agent, may be induced to embark upon a vigorous advertising campaign at his own expense; the name of the new agent would appear prominently in each announcement as a matter of course; and to have one's name linked up with an advertising campaign, no matter how small, is well worth the cost of postage upon a few letters applying for agencies.

If there is no advertising done, there is a possibility that the manufacturer may attach such importance to the proper development of the agency territory that he may take steps to work it at his own expense, either by sending out his own man to push business there, or by himself securing some of the business, which, though for the agent's market, is controlled or placed in London, such as many railway contracts, and work for certain large corporations. On all such transactions there is commission to be paid to the agent under the terms of the agreement.

There is a further chance of a more or less substantial contribution by the manufacturer towards office expenses, travelling, exhibitions, or the like; or perhaps the manufacturer may send out a large and imposing display of machinery upon open consignment terms, to be paid for when sold. The apparent possession of a valuable stock is an asset of considerable value to one's credit and standing.

On the manufacturer's side, the only thing which can be urged in favour of an agent without experience in the goods he proposes to handle, is the opinion which is held in many quarters that a poor agent is better than none at all. Any lengthy experience with agencies, however, will show that this is a fallacy, and that it is better to have a territory unallocated rather than be tied for a period of two or three years to an agent with no experience, and consequently doing no trade. It is said that opportunity knocks at everyone's door; and in the case of a market of any importance a manufacturer will find that, sooner or later, either by pure luck, or by his own efforts, he will get into touch with an established agent. He is the more likely to be approached by an experienced man if he is not already represented in that market. But what if, when the time comes, he is so unfortunate as to have already allotted the territory to the first one who chose to ask for it, and who may not be doing one pennyworth of business? The manufacturer must either let the new business pass him, buy the existing agent out for a lump sum, or be content to pay the latter an over-riding commission upon the new business out of his scanty profit: because let no one delude himself into thinking that when business of this description comes to book there are any odd five per cents. to spare!

The writer has seen this happen time after time, but the point is very well illustrated by one actual instance. A well-known British firm whose manufactures covered rather an unconventional range, including certain electrical machinery (for the production of which it was not very well equipped) and certain classes of agricultural machinery, in which it did a very good trade, decided for some reason or other to appoint as its agents in an Australian state a firm of electrical engineers. The business done under this agency was *nil*, as an electrical engineering firm is not usually the best channel for disposing of any quantity of agricultural machinery to farmers or the pastoral community. When the agency had half run its course, the manufacturers were approached suddenly by a large firm of agricultural implement agents in the same territory who were doing a large and regular trade, and who had just broken with their usual suppliers, with a suggestion for negotiations for a sole agency. The Australian firm was under the impression that the manufacturers were the only British firm of any standing making such implements who were not actively represented in that market, and were quite ignorant of the fact that they had an agent there. Put in a few words, the agents were prepared to purchase some two thousand pounds' worth of machinery at prices approximating the figures at which they had previously been buying, but one of the essential conditions was that they were to have the sole concession for the sale of these goods. After some exceedingly difficult negotiations, the electrical agent in possession was induced to relinquish the agricultural portion of his agency on condition that he was paid an over-riding commission upon the whole of the orders placed by the new people for a certain period, but retaining the electrical portion, which continued to be worked for many years with the same success as at the commencement. The agricultural business in the new hands, of course, was a big success as far as turnover was concerned, although from a financial point of view absolutely unremunerative to the manufacturers for some years by reason of the sacrifices involved at the commencement.

Yet a further point in favour of keeping a free hand in important territory, rather than appointing a poor agent, is that if the manufacturer has anyone on his staff with the requisite qualifications and a certain amount of time to spare, the latter can advantageously be utilised in approaching likely buyers direct. In India, for instance, if he has been so far unsuccessful in negotiating an agency with any of the large European firms, he could approach some of the smaller native firms, quoting them prices calculated on a c.i.f. basis, and in normal times it would not be long before persistent efforts in this and other directions resulted in business. With an established agency, the manufacturer would in most cases be debarred from any efforts on these lines.

In considering any application for a sole agency, it will be all to the good if it is possible to elicit information upon the following points:—

(1) Has business been done previously in the same class of goods, and of what makes?
(2) What results have been obtained in the way of turnover?
(3) What territory can be worked satisfactorily?
(4) How will the territory be covered, *i.e.*, branch houses, travellers, or sub-agents?
(5) Has the prospective agent thoroughly examined the prices and discounts quoted, and is he convinced that with the standard design he will be able to compete?

Finally, when considering point 3, let us always adopt the famous statesman's advice to use large-scale maps.

Developments in Tasmania.—The Hobart correspondent of the *Manchester Guardian Commercial* states:—"Important announcements are expected shortly in connection with the industrial development of Tasmania which has been more rapid during the past six years than at any time in the history of the State, thanks in the main to the State Hydro-electric enterprise. Nothing definite has yet been made public as to the nature of the proposed new industries, but it is known that big things are in the air and that if only a portion materialises it will mean valuable additions to the industrial wealth of Tasmania. When I interviewed Mr. J. H. Butters, general manager of the State Hydro-electric Department, on the subject, he was unable to give any definite information, but he went so far as to say that some of the business in hand, which had been developing for a year or so, was now very much alive."

Electricity Supply in Czecho-Slovakia.—According to a recent statement of the Minister of Public Works, there were formed last year in Czecho-Slovakia 17 electricity supply companies, whose capital totalled 250,000,000 kr. The State subscribed towards these new formations to the extent of 54,000,000 kr. The total capacity of the companies operating amounted to 100,000 kW, and the yearly output to about 120,000,000 kWh. The length of the networks aggregated 3,000 km.

Overhead Electric Power Transmission.

Elements of Design and Economics.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

The overhead insulated transmission line is the most economical means of transmitting electrical energy. As a matter of fact, from the time it was first known that electrical energy could be generated in one place and used at a distance, the pole line has proved one of the most useful engineering achievements of modern times. As regards the cost of insulation, the overhead system can afford to put in sufficient insulation to take care of the severest conditions, whereas for the same difference in service conditions and for sufficient insulation, an underground cable system would cost very much more.

What is required perhaps as much as anything else in this country at the present time is: (*a*) powers of compulsory expropriation for the purpose of installing overhead lines, or (*b*) some powers to make it possible to obtain cross-country wayleaves quickly and on reasonable terms. Overhead power transmission lines are often greatly hampered by inadequate rights-of-way, and in many cases easements can be obtained only on special conditions not always satisfactory or agreeable; for instance, one of the conditions often laid down is to the effect that standing trees must be left. This condition sometimes results in objectionable tangents in the line. To avoid the hazard and the additional expense involved in angle and dead-end supports, tangents should be as long as possible; whenever possible, the transmission route should be as straight as possible, as every bend involves a hazard. Also, wherever possible, overhead lines should be located away from cultivated areas, as rents for wayleaves are less and the lines themselves are less subject to interference, &c.

To ascertain whether a given transmission system is commercially possible or not, it is necessary to know the generating cost, the sale price, and the amount of delivered energy. In the determination of the most economical conditions, it is first necessary to establish the relation between the different parts of the transmission system and the principal independent variables. In arriving at the system costs it is better to divide the system into two parts, one part consisting of the transmission line itself, which is made up of line supports, line conductors, insulators, cross-arms, and all necessary line accessories, including earth wires and/or telephone circuits complete; the other part consisting of the various station costs, made up of power transformers, switchgear complete, lightning protection equipment, buildings, lands, and so forth. The cost of the latter portion is practically independent of the distance of transmission, whereas the cost of the former is directly dependent on the distance of transmission.

The total line cost varies with the locality, country, market conditions, angles in the line, span length, line voltage, allowable mechanical and electrical stresses, climate and temperature range, and cost of wayleaves or land. The cost of a line support is composed of the support itself, stays or struts, foundation, land, wayleaves or easement, and the erection cost. The cost of a metal line support must be considered from the standpoint of the different mechanical stresses, which involves the weight or tonnage of metal used, windage on the support, the vertical, longitudinal and transverse loads, the kind and quality of metal used in the support, class of foundation, and the cost of complete erection. A line support is high when the span is long, the line voltage high, and the sag of conductors great. The height of a line support depends on the line voltage, position of line supports as affected by the topography of the land, locality, span, sag, temperature range, and the minimum height allowable by law. There is a minimum height independent of the line voltage, span, sag, and the separation and arrangement of the line conductors. In the cost of nearly all high-voltage lines, the cost of line supports constitutes the predominating part of the total cost, and, for such lines, steel is now used in preference to any other material; the cost of this class of line support is practically dependent on the tonnage of metal used.

For the moderately high-voltage lines used in Great Britain and for span lengths up to a maximum of about 450 ft., the wood "A" frame is giving satisfaction. The economic spans of wood poles and steel poles of the lattice type are approximately in the ratio of two to one in favour of the latter. For conductors of moderate size commonly used in overhead lines (under usual assumptions as to limiting conditions of span lengths), the maximum spans for different kinds of metal used as line conductors are approximately: 800 ft. for hard-drawn copper; 1,000 ft. for copper-clad steel; and 1,500 ft. for steel-cored aluminium.

The use of wood poles, on account of their relative strength and shorter life, demands shorter span length (or less load in other ways), which results in an increase in the number and cost of line insulators, cross-arms, and total line accessories required per mile of line as compared with the steel pole. The value of long spans can scarcely be over-estimated, as long spans reduce the cost of wayleaves and eliminate a great quantity of line material; at the same time they give greater reliability of service due to the lesser chance of insulator failures. If the load upon a given wood pole be increased by an increase in span length or an addition of line conductors or other wires, its life will be reduced at an alarming rate; for instance, if we double the span length, the actual life will be reduced by about 50 per cent.—in other words, the factor of safety must be reduced by one-half. Depending on the original factor of safety, this reduction would usually not be allowable. Since the cost of line conductors is a constant for any given length of line, a reduction in the number of poles or an increase in the span length (which is the same thing) will result in a cheaper line, and a more reliable line from the viewpoint of service interruptions.

From a study of the principal factors which control the most economical design of line supports we are able to make a summarisation as follows:—

(1) For a given line voltage the *effective* height of line supports will decrease with a decrease in span length, and *vice versa*.

(2) With an increase in span of line supports and definite size of line conductors, the vertical and transverse loads will decrease.

(3) For a definite span of line supports, the *effective* height of the line supports will increase with an increase in line voltage.

(4) For a given span of line supports, the vertical and transverse loads will decrease with a decrease in the size of conductors, and *vice versa*.

(5) The *effective* height of line supports is proportional to the line voltage, to the square of the span length, and to the height prescribed by law.

(6) The *minimum* height of a line support is independent of the line voltage, span length of line supports, the sag, and the arrangement and spacing of the line conductors.

(7) For a definite span of line supports, line voltage, and transmission distance, the annual cost of line supports will increase with an increase in the size of line conductors.

(8) For a definite power in kVA, transmission distance, and generating cost of energy per kVA-year, the minimum cost for a definite span of line supports will increase with an increase in the size of line conductors.

(9) For a definite size of line conductors, line voltage, and transmission distance, there is a minimum annual expense for a certain span of the line supports.

(10) For a definite cross-sectional area of line conductor and generating cost of energy per kVA-year, there is a minimum cost of transmission for a certain span of the line supports.

(11) The cost of line supports will vary with their height and size, the kind and quality of material and foundations, the country, locality, and with the commercial conditions.

The most economical span of line supports is defined by the cost of line supports, insulators, fixtures, and all necessary line accessories. The cost of an insulator is dependent on the type and size or weight of porcelain. The size is dependent on the line voltage and on the insulating capacity. In the design of line insulators the mechanical strength is quite independent of the electrical, and the predominating one of the two defines the size. Generally, the mechanical strength is not the predominating requirement for high-voltage lines, as the porcelain body is sufficiently large and strong. The requirement for rated voltage of the insulator principally defines the cost: this cost varies with its weight and the cost of manufacture. When the units of a suspension-type insulator are small in size for a definite voltage, a greater number of units are required, and the string efficiency will be lower, resulting in a greater total cost for insulators; but when the units are very large in size, the cost of each unit will be high, owing to the increase of the rated voltage of the unit—this condition will also result in a greater total cost. Actually, the most economical suspension-type insulator is dependent on the size of units and the number of units for a definite line voltage.

The size of the insulator-pin is practically proportional to the weight of the insulator, and its cost (which is comparatively small) is usually included in the cost of the porcelain body. This is not the case for the suspension type of insulator, because the cost of caps and pins is to some extent independent of the weight of one unit of the complete string, and the cost is, relatively speaking, quite an item when it is required to suspend a heavy load, as would be necessary in the case of very-high-voltage lines, which are generally long. Pin-type insulators cost less than suspension-type insulators of equal efficiency. The use of pin-type insulators permits of shorter line supports and smaller spacing of the line conductors; the former effects a saving in the first cost of complete line support and foundation, or, alternatively, permits a greater loading due to the shorter overall length of the line supports which, again, is a saving; the latter, due to the advantage of a smaller spacing of line conductors, effects an improvement in the voltage regulation. A further advantage of the pin-type insulator is that sometimes there is less need for the installation of an overhead earth wire, but this advantage may be more than neutralised due to the extra flexibility usually available in the direction of the line with the use of suspension-type insulators. Records show that after about eight or nine years of operation, the frequency of insulator failures increases at an alarming rate, and interruptions in service become so numerous that it is necessary, in the majority of cases, to eliminate entirely the faulty units; expansion stresses due to the effect of temperature are one of the principal causes of insulator trouble.

From a study of the principal factors which govern the size, cost, and operation of line insulators, we are able to make the following summarisation:—

(1) For a definite span of line supports the cost of line insulators will increase with an increase in line voltage. And, for any line voltage, the cost for insulators will increase with a decrease in span length of the line supports.

(2) For the pin type and the suspension type of insulators the cost will decrease with the rated voltage of the insulator.

(3) For a definite line voltage a greater number of units are required for lines using the suspension-type insulator; the use of too small a size of unit will result in a higher total cost and lower efficiency of the string; on the other hand, the use of too large a size of unit results in a higher total cost due to the increase of rated voltage.

(4) For a definite voltage the cost is a *minimum* for a certain size and number of insulator units.

(5) Experience proves that service interruptions vary approximately as the square of the number of insulators used in the line.

The kVA capacity of a transmission line is directly proportional to the cross-sectional area of the line conductors and inversely proportional to the annual cost. The cost of line conductors is directly proportional to the distance of transmission, number of conductors, and the cross-sectional area of the conductors. The ohmic loss in a line conductor is directly proportional to the square of the line current and the ohmic resistance of the conductor. For long, very-high-voltage lines, the current is theoretically varying along the line owing to the effect of capacitance, but the difference is usually small as compared with the full-load current. The ohmic loss is variable according to the change of load, and the total energy loss in kVA-years is dependent on the load factor and the power factor. For a given percentage energy loss in transmission, the cross-sectional area of conductor required to transmit a given amount of power varies inversely as the square of the line voltage; for instance, we shall require four times the weight of copper if the voltage be reduced to one-half. The increase in size of conductor and consequent cost of conductors for a particular transmission has a definite limit depending on the cost of producing energy in some other way at the point of use.

From a study of the principal factors which control the most economical size of line conductors we are able to make a summarisation as follows:—

(1) The size of conductors increases with an increase in kVA capacity, with an increase in the cost of energy, and an increase in the load factor. When the load factor is high, the ohmic loss will tend to increase, and the annual expense on the investment to decrease, resulting in a high line voltage and large size of line conductors.

(2) For a definite distance of transmission and kVA capacity with a given line voltage, the size of line conductors will increase with an increase in the generating cost of energy per kVA-year.

(3) For a definite kVA capacity, transmission distance, and generating cost of energy per kVA-year, an increase in line voltage will result in a decrease in the size of line conductors.

(4) For a definite generating cost of energy, distance of transmission, and total kVA capacity, there is a minimum cost for a definite line voltage and given size of line conductors.

(5) For a definite kVA capacity, line voltage, and distance of transmission, the annual expense of ohmic loss in the line conductors will increase with an increase in the size of line conductors, and *vice versa*.

(6) For a definite kVA capacity, generating cost of energy per kVA-year, distance of transmission, and line voltage, the *minimum* cost of transmission will decrease with an increase in the size of line conductors up to a certain cross-sectional area.

(7) For a definite kVA capacity and transmission distance, an increase in the generating cost of energy per kVA-year for minimum cost of transmission will result in a larger size of line conductor for a certain transmission voltage.

(8) For a certain span of line supports there is a minimum cost of transmission for a definite cross-sectional area of line conductors and generating cost of energy per kVA-year.

(*To be continued.*)

Notes from Canada.

(From Our Special Correspondent.)

There has been a good deal in the Canadian papers (both daily and technical) recently, about the development of the St. Lawrence river. The subject has been discussed, on and off, since about 1896, but has never been so active as it is now. Both navigation and power interests are involved, the former being, to use the legal phraseology, "paramount."

Although reference has been already made to this matter from time to time in these "Notes," it is of sufficient importance to warrant further mention. No doubt many British manufacturers will become directly interested in St. Lawrence river power if and when it is made available, as it will probably be cheap power, and will be available over a very large area, thus giving manufacturers desirous of establishing works or factories here a wide range in the choice of sites for locating their plants.

The whole subject is a large one requiring very careful investigation. In the first place, as has already been pointed out, both navigation and power development must be considered; and in the second, there are two stretches of the river to keep in mind, one, the International section, which divides the Province of Ontario from the State of New York, and throughout which Canada and the United States are conceded to have equal rights; and the other and lower section, running through the Province of Quebec, which is therefore entirely in Canadian territory.

It will readily be seen from the foregoing statement that the interests involved are both varied and conflicting.

With regard to the proposed canalisation of the St. Lawrence river to render possible the bringing of ocean liners right to the Western end of Lake Superior, those Provinces of Canada and States of the Union which border the Great Lakes and which lie West of Lake Ontario, are in favour of the project. The cities of Montreal and New York, together with the railway companies likely to be affected are opposed to the scheme, as they believe it would be inimical to their interests. So far as power development is concerned, however, the provinces, states, &c., referred to are not raising any objection, because this would not affect them adversely.

The development of power on the International portion of the St. Lawrence is being very strongly urged in Ontario, and almost as strenuously opposed in the province of Quebec. The former province must within the next few years find fresh sources of power, and the St. Lawrence appears to be the natural river to which to turn.

Quebec opponents of this scheme profess to be averse to development of the International stretch of the river as liable to involve Canada in complications of a financial and strategic nature which it would be better for her to avoid, and they advocate the construction of the Georgian Bay Canal, for both navigation and power, as a desirable all-Canadian shipping route and source of power. This canal would connect Georgian Bay and Lake Huron with the St. Lawrence river at a point not far from Montreal, *via* a canal section and the Ottawa river. The Quebec people are strongly in favour of such projects being carried out and operated under private ownership, while those of Ontario are just as strongly in favour of public ownership. There is likely to be a long, keen fight on the whole matter amongst the various parties interested. In the meantime, Ontario *must* obtain more power before long, and the Premier of the province recently announced that, in view of the fact that the development of the St. Lawrence river might be considerably delayed, the Ottawa river (which has water power potentialities amounting to several hundred thousand horse power), would have to be developed, especially if additional diversion of water from the Niagara river could not be arranged for between the United States and Canadian Governments in the near future.

The United States Government has recently taken definite action in the St. Lawrence matter, as President Coolidge has just appointed a national advisory board to look into the whole project, and has asked Canada to do the same. It would seem that the opposing interests on this matter in the United States are less equally balanced than in Canada, since in the former country there appears to be a disposition to arrive at some definite decision more quickly than in the latter.

A rather curious feature of the situation is that in the most recent moves no attempt has been made, so far as one can ascertain from published information, to refer the question to the International Joint Commission, which was formed for the express purpose of dealing with matters of an international nature, such as are the proposed canalisation and development of the St. Lawrence river. It is true that that body has already had the subject under review and presented an exhaustive report to the two Governments about three years ago, which, based on the findings of the engineers appointed to investigate the matter, recommended the development of the river for the joint purposes of navigation and power supply. Possibly there is a desire to have reports on so important a question from other sources.

Involved in this problem of obtaining navigation on the Great Lakes for ocean-going vessels and of developing power on the rivers (Niagara and St. Lawrence) fed by these lakes, is the diversion by the City of Chicago of some 10,000 cubic feet of water per second for purposes of sewage disposal, a matter which was mentioned some time ago in these "Notes."

This diversion has aroused widespread opposition in the States bordering the Great Lakes, in the cities and towns along the banks of the Mississippi river, and in the province of Ontario. The first-named object on account of the lowering of the lake levels, the second because the sewage-laden water from Chicago flows down the river to them, while Ontario claims that the water diverted ought to be flowing down the Niagara and St. Lawrence rivers where it would be capable of generating altogether about half-a-million horse power.

Electric Furnaces.—Mr. A. Glynne Lobley (Reader in Electro-Chemistry at Manchester University) read a paper on "Electric Furnaces" before the Birmingham Metallurgical Society recently. Mr. Lobley described various furnaces designed for the melting of non-ferrous metals. He said that most modern furnaces were quite reliable, but he agreed that the capital cost was often unnecessarily high, even allowing for the small demand which at present existed. The running costs, on the other hand, were by no means heavy where electrical energy could be obtained at a reasonable price. Increased furnace loads, by improving the load and power factors of the supply, would tend to reduce the cost of electricity. A comparison was made of the thermal efficiency of the various kinds of furnaces, both fuel and electrical. Emphasis was given to a plea for an extended use of the simple and reliable wire-wound furnaces. The lecturer gave an account of his personal experience with the design and use of metallic resister furnaces, ranging from small laboratory types to industrial annealing furnaces. These had not only been found to be more satisfactory in every way than the fuel furnaces they supplanted, but had also been cheaper to erect and operate.

Czecho-Slovakian Import Exemptions. — Among the articles recently freed from the obligation of an import licence or declaration are the following:—Bulbs for electric incandescent lamps; boilers and boilermakers' wares, rough, not further worked, and not classified as machinery; wire cables of common metals or alloys thereof; and electric carbons weighing less than 1 kg. per linear metre.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Application of "Osglim" Lamps.

A method of using "Osglim" lamps in such a way as to make them perform a double duty has been devised by the makers, the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. The regulations for kinemas require that there shall always be a certain amount of illumination (and, indeed, it is a necessity). This light must be such as to

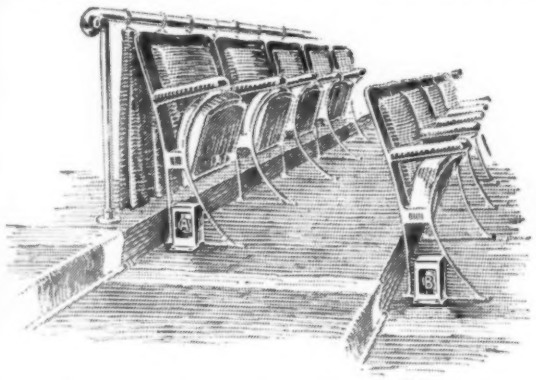


Fig. 1.—"Osglim" Lamps for Kinema Lighting.

interfere as little as possible with the exhibition of the films. At the same time in many kinemas which have adopted "booking" arrangements the indication of the position of seats is necessary. By placing an "Osglim" (neon) lamp at the end of each row of seats a subdued but adequate illumination is provided in the gangways, and at the same time the electrode of the lamp can take the form of a figure or letter to indicate the position of the row. Even when the main illumination is "on," these lamps will still perform their secondary function. The lamps can be installed in protective wire cages as shown in the accompanying sketch (fig. 1).

B.T.H. Loud Speakers.

For various reasons the vogue of the head-telephone as a means of receiving radio signals still continues almost unabated. One of the reasons for its popularity is the fact that it can be used on a crystal or a single-valve set without amplification. Another and very potent reason is that the majority of listeners have a not unjustifiable prejudice against the *average* loud speaker. The common failings of loud speakers have been thoroughly considered in the design of the new

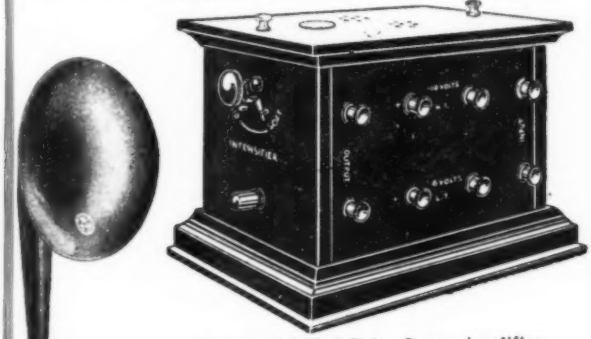


Fig. 3. B.T.H. 2-Valve Power Amplifier.

Fig. 2.—B.T.H. C1 Loud Speaker.

Fig. 4. B.T.H. Gramophone Attachment.

apparatus developed by the British Thomson-Houston Co., Ltd., of Rugby, which is shown in the accompanying illustrations.

The "C1" (fig. 2), "C2," and "C3" instruments are designed somewhat on the lines of a standard telephone receiver. To the poles of a permanent magnet are attached two soft-iron pole-pieces on which the actuating coils are wound. Supported very close to the pole-pieces is an iron diaphragm, which is caused to vibrate in accordance with fluctuations in the actuating coil current. Moulded insulating material is used throughout, while the permanent magnets are made of cobalt magnet steel, and a variable airgap is provided, adjustment being made by means of an accessible screw to give the best results under any conditions.

Another pattern of loud speaker is of the electro-dynamic "D" type. Its magnetic field is permanent, and is generated by a battery of cobalt-steel magnets, the provision and maintenance of a large capacity accumulator thus being rendered unnecessary. The output terminals of the two-stage amplifier (fig. 3) with which it is recommended that this type of loud speaker should be used, are connected by means of the instrument terminals to the primary winding of a telephone transformer within a circular base of moulded insulation on which the magnetic structure is mounted. The secondary winding of the transformer is connected by a moving coil, which floats freely in the permanent magnetic field. Any variation of the current in the coil winding causes a corresponding movement. The coil is rigidly attached to a diaphragm of ruby mica, and this vibrates in sympathy with the current variations in the coil.

A further device is an attachment for a gramophone horn (fig. 4) which is thus made to perform the functions of a loud speaker.

Improvements in "Henley" Ironclad Service Cut-outs.

A new catalogue issued by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C., draws attention to improvements in the design of the company's ironclad service cut-outs. The new bridge-type fuse carrier, designed to comply with Home Office requirements, has not only the voltage, but also the working and fusing currents

Fig. 5.—Fuse Carrier with Marked Ratings.

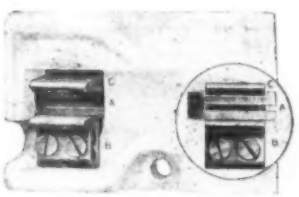


Fig. 6.—"Floating" Terminal.

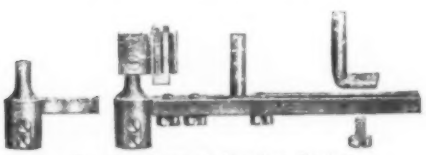


Fig. 7.—Channel Bus-bar Fitting.

moulded on the porcelain (*vide* fig. 5). Facsimiles of certificates issued by the National Physical Laboratory are reproduced in the catalogue, and furnish corroboration of the highly satisfactory performances claimed for these cut-outs. Two new ranges of cut-outs are manufactured. One range is rated at 15 A working, 30 A fusing, and 1,000 A short-circuit current, the other, which is a larger range, is rated for 30 A working, 60 A fusing, and 2,000 A short circuit.

The full range of 30/60 A apparatus includes single pole, with and without combined sealing chamber, single pole watertight, two-, three- and four-pole, combined with sealing chamber, and multi-pole cut-outs without sealing chambers in two-, four- and six-way, single- and double-pole. Considerable ingenuity has been exercised in designing this range, limiting the number of parts to a minimum. The fixing centres of the bridge-type, the open-type, and the neutral-type units are the same, so that it is possible to build up any required arrangement by using only standard unit parts.

A feature of the new cut-outs is the improvement in the method of fixing the contact terminals. This consists of a patent "floating" terminal (fig. 6), which removes one

possible source of failure, as the terminal is secured to the porcelain base by means of a phosphor bronze spring fork which renders it self-aligning, and avoids the old method of passing through a fixing screw from the underside of the porcelain base into the terminal; thus any leakage to the cast iron case is impossible.

In the carriers cup washers are provided; these not only facilitate wiring, but also prevent damage to the fuse wire. Indentation of the fuse wire is often the cause of premature fusing.

The multi-pole cut-outs are fitted with a new type of channel bus-bar, which makes a first-class job (see fig. 7). This is a "universal" fitting which can be arranged for any number of ways by the simple fixing of connector pieces (round rod with a flattened end bent at right angles) to a bar of channel section by means of a screw.

Included in this catalogue is a new double-pole ironclad quick-make and quick-break switch rated at 15 A for 500-V circuits, also particulars of tests showing that it complies with the requirements of the B.E.S.A. specification for totally-enclosed airbreak switches for this voltage.

The same switch interior is also used in a new combined switch and fuse box, described in the catalogue.

The Turbine Breakdown at the Shanghai Electricity Works.

The following extract from the *Municipal Gazette*, Shanghai, March 13th, 1924, has been received through Reuter's Agency:—

Electricity Department.

Riverside Power Station Disaster.—The following report by Messrs. A. McLean Ranft and D. Somers Brown, sent out by Messrs. C. A. Parsons & Co., Ltd., to investigate the circumstances under which a 20,000-kW turbine was wrecked on November 15th, 1923, is published for general information.

Shanghai, February 27th, 1924.

Dear Sir,—With reference to our conversation this morning at your office, the following telegram was received to-day from Messrs. C. A. Parsons & Co., Ltd.:—

"It is now possible to throw further light on the accident which occurred to the 20,000-kW steam turbine at Shanghai in November last. It has been suggested that the accident was caused by increase in speed of turbine beyond normal; although the evidence shows that this did not occur, it seems desirable to give sequence of events should a turbine of this design overspeed. First, disks would come loose on turbine shaft as stress of centrifugal force overcame allowance for shrinkage between disks and shaft; the disks coming loose would cause blades to jam, and fouling of blades would take place. Under these conditions it would be impossible for turbine to continue to accelerate, but even if this were possible, disks would have to attain speed of 3,000 revolutions per minute and shaft a speed of 4,000 revolutions per minute before they would burst.

"The normal speed of the machine in question was 1,500 revolutions per minute. From this it is evident that if the shaft were of even moderately sound material, it would be extremely unlikely for the machine to reach such a speed that the shaft would burst.

"The engineer-in-chief, Shanghai Municipal Electricity Department, has held an inquiry at which it was disclosed that at the moment before the accident occurred there was nothing abnormal in running of turbine, nor was there shadow of evidence that turbine had exceeded normal speed. The whole of the evidence so far received from our engineers who were sent to Shanghai to report shows that the accident was caused by rupture of turbine shaft.

"Photographs of fractured shaft and diagrams showing positions and nature of fractures have been fully discussed with technical experts of makers of shaft forging, and they are in agreement with us that all evidence points conclusively to the accident having been due to a concealed defect (probably a clink) in interior of the steel forging. The forging in question was obtained from one of the experienced steel firms in this country. The shaft forging was made from a cold ingot in 1921, when the precautions which were known to be necessary during manufacture of large forgings of alloy steels were not as fully appreciated as they are to-day in respect to medium carbon steel forgings of dimensions required for this shaft. All medium carbon steel forgings of large or varying sections are treated to-day in a manner similar to the highest class of alloy steels for ordnance under the direct supervision of the steel-makers' metallurgical experts, and from the casting of the ingot to the final quality heat treatment, the material is not allowed to become cold. These precautions and the present almost universal practice of boring holes through the centre of shafts for internal inspection and examination have reduced possibility of repetition of such an accident to minimum.—Turbo."

The accepted interpretation of the metallurgical term (clink) is an internal crack due to heating the forging too quickly, and may be developed by forging into a cavity of dimensions according to the size of the original crack and the amount of forging which has been put upon it.

After our preliminary survey at Riverside, a critical examination was made of the damaged parts of the turbine, and all the available information covering the running of the plant at the power station was carefully considered. The evidence obtained suggested that the accident was caused by the breaking of the turbine shaft, all the other damage being consequential.

The turbine shaft was found broken into three main portions, transversely and lengthwise. When these were assembled and co-related, it was found that several pieces of shaft had broken away from the transverse fracture, also that a portion of shaft was tightly wedged in the cast steel turbine casing. When all the shaft parts were co-related, a longitudinal irregular fracture was disclosed at the centre of the largest diameter of the shaft, indicating that during the process of forging, this fault had developed, extending longitudinally and outwards, leaving a comparatively small section of sound material. The nature of the fractures suggests that the final breaking of the shaft was instantaneous, and would not give any warning or indication to those responsible for running the plant.

In conclusion, we wish to take this opportunity of expressing our thanks and appreciation for your guidance and assistance, and for having placed at our disposal unreservedly the evidence and information you had collected prior to our arrival in Shanghai, which has been of material assistance in carrying out the investigations.

We would like you to convey to your officials and staff our appreciation of their valuable assistance in this matter.

Yours faithfully,

A. McLean Ranft,
D. Somers Brown.

T. H. U. Aldridge, Esq., M.I.E.E., M.I.Mech.E., Fel.A.I.E.E.,
Engineer-in-Chief and Manager,
Shanghai Municipal Electricity Department.

Parliamentary.

[By Our Special Parliamentary Reporter.]

Broadcasting.—On April 14th, Mr. Baker asked the Postmaster-General whether the sum which he was entitled to retain from the receipts due to the issue of broadcasting licences was intended to recoup him for the cost of issuing licences and to pay for the services rendered by his department in safeguarding the interests of the licence holders; and, if so, would he state what steps he had taken to minimise the interference by Morse during broadcasting hours.

Mr. Hartshorn said that the sum of 2s. 6d. which was retained by the Post Office in respect of each licence fee was intended to cover all work in connection with such licences, including issue, accounting, renewal, inspection, correspondence, and administrative control. In the present state of development it was not possible entirely to prevent interference.

Mr. Baker also asked the Postmaster-General whether he was aware that it was estimated that £300,000 would be paid to the Broadcasting Company in respect of wireless receiving licences for the 12 months ending March 31st, 1925, this sum being ten times the amount taken in the estimates for the financial year just completed; and whether he would state what power he had to supervise the expenditure of the company.

Mr. Hartshorn said that the payments to the British Broadcasting Company were made by instalments in arrear; and the provision in the vote for 1923-24 represented only a small proportion of a full year's income. As regarded the last paragraph of the question, he referred Mr. Baker to Clause 7 of the supplementary agreement with the company which was laid before Parliament.

On April 15th, Mr. Baker asked the Postmaster-General whether he was aware that broadcasting took place from three centres in Paris, two in Brussels, three at the Hague, two in Berlin, and two in Madrid, in addition to many other towns in France, Belgium, Holland, Denmark, Germany, Czecho-Slovakia, and Switzerland; and whether, in these circumstances, he would have inquiries made and a report issued giving details of the transmission, wave lengths, power, and times, with the names of the owners of such stations and the extent to which they were owned and controlled by the respective governments.

Mr. Hartshorn said that most of the details referred to were published regularly in the various wireless journals. This appeared to be the most convenient method of meeting the requirements of listeners-in in this country who wished to intercept foreign programmes; and he did not consider that the expense of issuing an official report on the subject would be justified. The majority of the broadcasting stations on the Continent were operated by private companies under Government control. Only two or three of them were Government owned.

Hart Accumulator Works Dispute.—On April 14th, Mr. GROVES asked the Minister of Labour whether his attention had been called to the dispute at the Hart Accumulator Works at Stratford involving the stoppage of 150 workers; whether he was aware that hitherto the firm had declined to meet either the men or their trade union representatives or to submit the matter to arbitration; and would he at once take the necessary steps to bring the parties together with a view of settlement of the dispute.

Miss MARGARET BONDFIELD, Parliamentary Secretary to the Ministry of Labour, said that this dispute was reported to the Ministry of Labour and a joint conference between the two sides was arranged by the department. No settlement was reached but the department was still in touch with both sides.

Trade Facilities Bill.—On April 14th, during the Committee stage of this Bill, on Clause 1, which increases the amount which may be guaranteed under the Trade Facilities Acts of 1921 and 1922 from £50,000,000 to £65,000,000, Sir BEDDOE REES moved an amendment to ensure that the additional £15,000,000 should be used exclusively for such capital undertakings as were not able without guarantees to secure the necessary loans on the financial market.

Mr. GRAHAM, on behalf of the Government, resisted the amendment, preferring to leave the matter in the hands of the Advisory Committee.

Mr. SHORT, a Labour member, said the feeling was growing that the credit of the State was being used to give support to people and companies which were in a position to finance their own undertakings. Were they to understand, for instance, that the well-known shipbuilding firm of Harland and Wolff, which occupied an unequalled position in the shipbuilding industry, could not raise sufficient money without securing a guarantee under the Act? Then the Royal Mail Steam Packet Company—a very substantial company, and well grounded—also secured a guarantee, as did the London Electric Company (*sic*) to an amount of £2,356,000 and the South London Electric Company (*sic*) to an amount of £3,769,000. He was inclined to think that these well-established companies ought to have been able to float their own undertakings without State guarantees.

The amendment was negatived.

Wired and Wireless Telegraphy.—On April 15th, Mr. BLACK asked the Postmaster-General how much saving in cost would accrue by a general use of the wireless system as compared with the telegraph, both with regard to the cost of transmission and also with respect to the cost and upkeep of necessary plant; whether there was in contemplation any further laying down of telegraphic cables; and whether the future policy with respect to this matter had been determined.

Mr. HARTSHORN said that there were more than 10,000 telegraph lines in this country, over 1,200 terminating in the Central Telegraph Office, London, alone. The number of telegraph channels of communication afforded by these wires was much larger still, and it was entirely impracticable to replace this system by "wireless." There were, moreover, 78 wires, giving nearly 200 channels of communication, between the Central Telegraph Office and offices on the Continent. There was no present probability of maintaining these foreign services by "wireless" and the Post Office, like other telegraph administrations and companies, did not contemplate discontinuing the provision of telegraph cables where required.

Industrial Disputes.—On April 15th, Miss BONDFIELD, Parliamentary Secretary to the Ministry of Labour, informed Mr. LAMBERT that the numbers of working days lost through industrial disputes in Great Britain and Northern Ireland in 1919, 1920, 1921, 1922, and 1923 were approximately 35 millions, 26½ millions, 86 millions, 20 millions, and 10½ millions respectively. For the months of January and February, 1924, the corresponding figure was over 1,300,000. The foregoing figures related only to days lost at the establishments where the disputes occurred, and no figures were available as to days lost at other establishments. Disputes involving less than ten workpeople, and those lasting less than one day, were not included in these figures unless the aggregate duration (*i.e.*, the number of workpeople involved, multiplied by the number of working days) exceeded 100 days.

West Indian Cables.—On April 15th, Sir HARRY BRITTAIN asked the Colonial Secretary what proportion of capital, if any, of the Halifax-Bermudas Cable Co. and the Direct West India Cable Co. was held in America or by American citizens.

Mr. THOMAS said he was informed that the capital of these companies was at present held approximately in the following proportions: 45 per cent. by British subjects in their own right, 35 per cent. by British subjects as nominees of the Commercial Cable Co., and the remaining 20 per cent. by United States nationals. Arrangements had, however, been made for the transfer of certain stock now held by the Commercial Cable Co. to the chairman of the board of the Bermuda companies, who was a British subject, so as to increase the proportion held by British subjects to 55 per cent. in the case of both companies.

Arc-Lamp Carbons.—On April 16th, Mr. LUNN, Secretary to the Department of Overseas Trade, informed Mr. Linfield that the total quantities and values of "Electric Carbons, Lighting," of United Kingdom manufacture, registered as exported to all foreign countries in the years specified were as follows:—1921, 1,474,156 (£12,198); 1922, 1,513,196 (£8,950); and 1923, 654,649 (£3,106). The total quantities imported into the United Kingdom in the years specified were as follows: 1921, 7,126,258; 1922, 2,941,848; and 1923, 5,388,397. Corresponding particulars for 1920 were not available.

The Leafield Wireless Station.—On April 16th, in reply to Capt. R. TERRELL, Mr. HARTSHORN said that the effects of the modifications of the circuits in use at the Leafield Station which were recently made were still under investigation, and everything practicable would be done to minimise interference with broadcast reception by the working of the station.

Legal.

Alloy Welding Processes, Ltd., and Jones v. Weldrics (1922), Ltd.

ON December 5th, 1922, Alloy Welding Processes, Ltd., and Ernest Henry Jones commenced an action against the defendants in respect of alleged infringement of Letters Patent, 127,315 of 1917 and 157,534 of 1919, relating to electrodes.

Weldrics (1922), Ltd., defended the action on the grounds that both of the said Letters Patent were invalid, and, moreover, that the defendants' electrodes were no infringement of either of the plaintiffs' Letters Patent.

On March 12th, 1924, the plaintiffs applied for, and were granted leave to discontinue the action as to both patents, and were ordered to pay the defendants' costs. The plaintiffs also undertook to bring no further action in respect of the infringements complained of.

H.M. Inspector of Factories v. Lithgow, Ltd.

ON April 10th, in the Greenock Sheriff Court, judgment was delivered in this case, which has received previous mention in our columns (see our issue of April 11th, p. 575). The Sheriff was called upon to decide whether the company or one of its foremen was responsible for the death of a workman, due to electric shock, following upon a breach of regulations.

The defendants' works manager stated that after the accident he discovered that an earth connection had not been made, and consequently the metal work of a lighting fitting was rendered "live." The foreman admitted that he had forgotten to make the connection. The Inspector (Mr. McColgan) maintained that the works manager was responsible; it was his duty to see that the regulations were complied with. The Sheriff, in delivering his judgment, said that the foreman had had 40 years' electrical experience, and if the company was to appoint somebody to supervise him, there seemed little justification for a foreman. He held that the foreman was a competent and authorised person under the regulations, and was responsible for the occurrence. However, he thought that the foreman had suffered sufficiently from the shock which the accident had given him, and he was therefore discharged. The employers, the Sheriff concluded, were not at fault.

Charge against an Engineer.

The Times reports that at Bow Street Police Court, on April 15th, Henry Singleton (43), an engineer, of Croydon, was remanded, on £200 bail, charged with obtaining from three engineering students' sums of £35, £35, and £45 by false pretences.

Mr. CLAYTON, for the Director of Public Prosecutions, said the defendant was alleged to have obtained deposits amounting to between £600 and £700, chiefly from boys, on the promise of teaching them the engineering profession. The case for the prosecution was that he was never in a position to carry out his promise. Detective-Sergeant Collins stated that in reply to the charges the defendant said, "Something happened that was beyond my control. Otherwise I should have carried out my promise."

Singapore Electric Tramways, Ltd.

IN the Chancery Division, on April 16th, Mr. Justice Eve had before him a petition to sanction a scheme of arrangement between the debenture holders and shareholders of the Singapore Electric Tramways, Ltd.

Mr. TURNER said the company was formed to work a tramway undertaking in Singapore. Difficulties arose in 1921, and in 1922 a receiver was appointed in a debenture holder's action. Under the scheme before the Court a new company was to be formed which would satisfy the claims of the various parties by an issue of £250,000 of debenture stock.

His Lordship confirmed the scheme.

Wiring Installation Claim.

AT Birkenhead recently, Mr. J. Berkson, of Ashville Road, Birkenhead, claimed from Mr. R. S. Eccles £13 10s. damages for alleged breach of contract with regard to an electric light installation in two houses in Ashville Road.

Plaintiff's case was that defendant was engaged to install 22 electric lights. The light was not used until four months

had elapsed. After the first two days, the lights failed. Defendant renewed some of the wire on three occasions, but the same thing happened again. The premises had to be rewired at a cost of £17 10s.

Defendant said that he was an electrical contractor. He submitted three tenders, and eventually the third, amounting to £10 8s., was accepted. The wires were put in tubes, and these were inserted in the walls. The trouble arose through damp walls. He alleged that the plaintiff had said that he did not require a first-class job, but just wanted to pass the Corporation test.

The case was adjourned.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

The Court of Appeal, on April 15th, adjourned the hearing of the appeal of the British Insulated & Helsby Cables, Ltd., from the judgment of Mr. Justice Russell, until April 29th, when Sir Arthur Colefax, K.C., will continue his address on behalf of the B.T.H. Co. in support of the judgment of Mr. Justice Russell.

British Thomson-Houston Co. Litigation.

In the Chancery Division, on April 16th, Mr. Justice Eve, on the motion of Mr. Trevor Watson, for the British Thomson-Houston Co., Ltd., gave judgment in default of appearance and defence against Delmericks, of Uxbridge Road, W. Counsel said the action was to restrain infringement of letters patent. It was a case in which the patent had been upheld.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Employment in Australia.

In his letter under this heading in your current issue, "Anglo-Australian" makes the statement that the cost of living in Australia is generally conceded to be from 30 per cent. to 40 per cent. higher than in this country.

I wish to question this statement and to say that in my opinion any such disparity as may have existed in pre-war days has been wholly wiped out by the subsequent rise in prices here, with the result that to-day the cost of living is practically identical in both countries.

On the other hand, I confidently assert that as regards their general standard of living, including full employment, ample wages, moderate hours, comfort, recreation, ability to save, climate, and last, but not least, freedom from harassing political complications, Australians are far ahead of this or any other country, not excepting the United States.

I further consider that living as they do, in common with the rest of the Dominion peoples, under the protection of the Mother Country and contributing hardly anything to the immense standing cost of Imperial defence, the strenuous campaign they have been carrying on for some time past to secure further favours in the shape of preference in the home markets on certain of their foodstuff products is ill-conceived and ill-timed, as indeed Mr. Baldwin and the Conservative Party found out to their cost last December. The so-called preference which Australia loudly claims to be giving to British products is a gift horse, consisting as it does of merely a small percentage reduction in the excessively high scale of protective duties which she has imposed in order to shut out manufactured imports, whatever the country of origin, in pursuance of her policy of making herself industrially self-supporting.

Another Anglo-Australian.

April 14th, 1924.

Service Charges.

Can any of your readers inform me whether they have come across a more ridiculous charge than the one I have been asked to pay? The supply authorities have recently connected up some premises for me from their h.p. mains, and it required a total length of cable from the centre of pavement to the cellar of exactly 4 ft. For this long job I am charged the enormous sum of £5 as connecting fee, and on inquiry being made I am told that this is a general charge. Are supply authorities allowed to mulct the public to this extent? Having had experience with about ten supply companies and never having been asked in any similar instance for a charge, this you may well believe leaves me—

Beamless.

April 15th, 1924.

The Late Mr. George Hookham.

I should like to supplement the notice on page 586 of the Electrical Review, as it contains no reference to one of Mr. Hookham's most important achievements and the one by virtue of which he was most widely known both in the British Isles and all over the world. I refer to his great share in the production of the earliest electricity meters.

It was, I believe, about the year 1885 that Mr. Hookham first had his attention called to the need that would certainly arise within the next few years for a thoroughly reliable and reasonably cheap form of electricity meter, and it was in the year 1887 that his first meters were made. It was soon found that the earliest patterns were hardly suitable, but in 1891 Mr. Hookham took out his first patent for a meter consisting of a copper disk entirely submerged in mercury. This system was the basis of all his subsequent developments in the field of direct-current meters, and is the system adopted by all other makers of mercury motor meters.

The modern mercury motor meter may therefore be regarded as entirely due, at any rate in its inception, to Mr. Hookham's inventive skill and ingenuity.

S. H. Holden,
Chamberlain & Hookham, Ltd.

Birmingham, *April 16th*, 1924.

The Bellini-Tosi Radio Direction Finder.

I would like to suggest that the summary of the paper I read recently before the Wireless Section of the Institution of Electrical Engineers, printed in the Electrical Review of April 4th, under the heading "Bellini-Tosi Radio Direction Finders," gives in certain places an impression somewhat different from the actual text of the paper.

Lines 35 to 45 in particular give an impression that the subject is vague and the results uncertain. I would like to say that this is far from being the case.

John A. Slee,
Technical Manager,
The Marconi International Marine Communication Co., Ltd.

London, *April 16th*, 1924.

Squirrel-cage Motors of Over 5 h.p.

Mr. Lydall is in error in your issue of the 4th inst., and consequently it is his claim that is unique, and not the performance of the clutch.

My old clutch has frequently been set to come in *after* full speed has been reached. But it means extremely accurate governing.

A. E. Woodhouse.

London, *April 15th*, 1924.

The A.C. Commutator Motor and the Engineer's Education.

While in this country the demand for a.c. commutator motors is gradually increasing, owing to the appreciation of their inherent qualities which are vital to many industrial applications, I regret to notice a great lack of knowledge on this subject on the part of operating engineers.

This fact, which manufacturers know by direct contact with the labour market, can be traced directly to the lack of serious publications on the subject, and the lack of appreciation and understanding on the part of many technical teachers.

The advent of the induction-type motor, with exaggerated views with regard to its merits and simplicity, was responsible for the holding-up of progress on this class of machines, both from a designing and a manufacturing point of view.

The time has arrived, I believe, when these motors, at least for moderate sizes, could be of more general use, and unless the knowledge of their fundamental principles acquired by electrical engineers is widened, their progress will be hampered by doubts as to their satisfactory performance.

How many technical schools and universities have taken this subject seriously?

How many have got plant to experiment with and show to the students?

N. Pensabene-Perez.

London, *April 17th*, 1924.

The National Register of Electrical Installation Contractors.

A few weeks ago you were good enough to comment favourably in your journal on the inauguration of the National Register of Electrical Installation Contractors, for which I now take the opportunity of thanking you cordially. It will no doubt interest you to know that certificates of registration are now being issued to installation contractors who comply with the requirements of the body, and that applications for registration are being dealt with as rapidly as the necessary investigations make possible.

The National Register proposes to publish in your advertisement columns at an early date a first list of registered contractors under the headings of the respective towns or localities in which they carry on their businesses. The need of such a register is unquestioned, judging by the manner in which its establishment has been received, and by the absence of any unfavourable comment or criticism, and is evidenced by the stream of applications for registration which is steadily flowing in, and the inquiries which accompany these applications as to publication of the names of those applicants entered on the register and to whom certificates are

granted. May I ask you to bring to the notice of wiring contractors who have not yet sent in their applications, through your widely read columns, the advantage of doing so at the earliest moment if they desire their names to appear in the first list of Registered Installation Contractors entered on the register to be published, and to remind them that every application takes a certain amount of time for investigation before names can be passed by the Executive?

The fee payable on application covers registration until April 30th, 1925, when the Registered Contractors' Certificates become renewable. Applications should be addressed to the Secretary, 1, Lincoln's Inn Fields, London, W.C.2, who will supply application forms and answer any queries.

Inquiries as to the publication of lists of registered Installation Contractors are not confined to applicants for certificates and those to whom they have been granted, but are coming in from quarters in which lies the giving-out of wiring work, and the wish to comply with such an evidenced desire is the main reason for my asking for your kind offices, and the indulgence of your columns in reaching the interested parties concerned.

C. H. Wordingham,
Chairman,
National Register of Electrical Installation Contractors.

London, *April 19th*, 1924.

Radio Valves.

Would it be possible to prevail upon the principal valve manufacturers to mark the bulb or cap with the filament volts and amperes, and also the plate voltage?

If there are technical difficulties in the way, surely the cost of printing this information, together with the characteristic curve, either on the carton or as a leaflet to be packed with each valve, should not entirely absorb the margin of profit on an article which is retailed at from 12s. 6d. to 55s.

London, *April 17th*, 1924. **Valve.**

A Transmission Line Problem.

With reference to Mr. Lacey's article on "A Transmission Line Problem" in your issue of the 22nd ultimo, I herewith draw your attention to a few small errors which I am sure could be classified under the Printer's devils. The errors might have already drawn attention from someone in England by now; but I think it is never too late. They are:—

Page No. 284, second column, 12th line: "OB" should read as "OD."

Page No. 285, first column, 2nd line, and Page No. 285, second column, 21st line: "E" should read as "EF."

Simla, India, *March 31st*, 1924. **G. P. Ponday.**

Business Notes.

Bankruptcy Proceedings.—ARTHUR WILLIAM BOULD, 29, High Street, Skipton, Yorkshire, electrician.—The first meeting of the creditors herein was held on April 11th at the Official Receiver's Offices, 12, Duke Street, Bradford. According to the statement of affairs there were liabilities amounting to £467 and assets estimated to produce £71, leaving a deficiency of £395. Debtor attributed his failure to lack of trade, heavy overhead charges, and interest on borrowed money. The case being a summary one was left in the hands of the Official Receiver as trustee of the estate.

J. E. ELLIOTT & Co. (John Edward Elliott and James Mountjoy Elliott, trading as), 12, Broad Street, Oxford, electrical engineers.—An application for an order of discharge was made on April 16th to Mr. Registrar Hope, at the London Bankruptcy Court, on behalf of these bankrupts, who failed last September. The Official Receiver reported that the joint unsecured indebtedness amounted to £2,902, while the estate had realised £172. The Official Receiver gave particulars of the affairs and trading of the debtors as published in these columns at the time of their public examination, and added that they attributed their insolvency to depression in trade, to loss on contracts, to loss in consequence of the forced sale of their stock and office furniture by the sheriff, and to depreciation of the goodwill of their business. Trading and profit and loss accounts were prepared annually until December 31st, 1913, but not since, the reason for that given by the debtors being that they did not possess enough money with which to pay their accounts. They admitted that they knew that they were insolvent in August, 1920, and that they had since lost, over three contracts, sums amounting to £370 due to under-estimating. It further appeared that since then debts amounting to £1,910 had been contracted. As offences the Official Receiver submitted and reported that the debtors' assets were not of a value equal to 10s. in the £; that they had omitted to keep proper books of account; and that they had continued to trade with knowledge of insolvency. His Honour suspended the debtors' discharge for two years.

R. McL. ALEXANDER (carrying on business with R. E. Hughes as R. E. Hughes and Hughes and Alexander), house furnisher and electrical and wireless engineer, 129, Brockley Rise, S.E., and 51, Honor Oak Park, S.E.—Discharge granted subject to debtor's consenting to judgment being entered against him for £5.

W. J. DICKEN (W. Dicken & Son), electrical engineer, 2, High Street, Bargoed.—First and final dividend of 8¼d. in the £ payable April 25th at the Official Receiver's office, 34, Park Place, Cardiff.

C. K. WALLIS, electrical engineer, late of Bedford Street and Longford Road, Bognor.—First meeting April 29th, at the Official Receiver's offices, 12a, Marlborough Place, Brighton. Public examination May 7th, at the Court House, Brighton.

W. E. WEEKS, wholesale electrical dealer, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol.—Last day for proofs for dividend May 2nd. Trustee, Mr. J. P. Emett, 18, Nicholas Street, Bristol.

J. H. WHITEHOUSE, electrical engineer, 61, Martin Street, Morriston, Swansea.—First and final dividend of 3¼d. in the £, payable May 28th, at the Official Receiver's offices, Government Buildings, St. Mary's Street, Swansea.

AUBREY VICTOR CLAYTON, 7, Woodhouse Square, Leeds, carrying on business at Park Lane Mills, Chorley Lane, Leeds, as an engineer, under the style of "Clayton Motors."—A first and final dividend is to be declared in this matter. The liabilities as per debtor's statement of affairs were £6,412, and the estimated amount available for dividend is £50. Mr. H. Clifford Bowling, Official Receiver and Trustee, 24, Bond Street, Leeds.

T. G. H. WILEY (Wiley & Co.), electrical engineer, late of Cemetery Road, Pudsey, and Oxford Place, Stanningley, Yorks.—First and final dividend of 6d. in the £, payable at the Official Receiver's office, 12, Duke Street, Bradford.

Company Liquidations.—BRITISH RADIO SALES CO., LTD.—A petition for the winding up of this company has been presented by the British Broadcasting Co., Ltd., of 2, Savoy Hill, W.C., and will be heard in London on April 29th.

G. H. TURNER & Co., LTD., 101, High Street, Harlesden, London, N.W., and Cross Street, London, E.C., electrical contractors, &c.—The creditors interested herein were called together recently, when Mr. P. M. Harper, I.A., of 329, High Holborn, W.C., submitted a statement of affairs which showed gross liabilities of £2,472, made up as follows: Debenture-holders, £695; cash creditors, £319; trade creditors, £1,038; expense creditors for rent, light and power, £359; and apprentices' premiums, unexpired, £60. The total assets were £2,118, or a deficiency of £354.

The Liquidator (Mr. Harper) reported that the company was registered on October 28th, 1912, with a nominal capital of £1,500, of which £1,052 had been issued and was fully paid. On November 6th, 1912, debentures for £350 were issued, but half that issue was subsequently repaid. On March 17th, 1915, second debentures for £500 were issued, and were still outstanding. Early in 1917 the debenture-holders appointed Mr. Turner to act as receiver on the ground that their security was in jeopardy. Mr. Turner had acted as receiver and manager ever since. The company went into voluntary liquidation on March 29th of the present year, when Mr. Turner's appointment as receiver was terminated, the idea being that the liquidator should also act as receiver. The present position had been largely brought about owing to the ill-health of Mr. Turner, and so far as could be seen there had been every endeavour made to finance and carry on the business. During last year the debenture-holders found a further £300 for the company without security. The excess of unproductive wages had also contributed to the present position. Some of the work in progress had been completed since the liquidation took place, but the premises had now been closed down. It was proposed to realise the remaining assets. There was a probability of the assets being increased by £90 or £100, representing a refund of income tax.

After a lengthy discussion a resolution was passed in favour of the meeting being adjourned with a view to the debenture-holders being approached to see whether they would agree to rank as unsecured creditors in respect of their claims.

The following are creditors:—

	£		£
Callender's Cable & Construction Co.	18	Calmont, King & Co.	24
Hall & Brenard, Ltd.	22	Cox & Edwards	46
Leverett & Co.	24	Edison Swan Electric Co., Ltd.	55
Chafer Bros. & Bury	75	Falk, Stadelmann & Co.	142
J. & W. B. Smith	204	General Electric Co., Ltd. ...	27
Credenda Conduits, Ltd. ...	40	Perrett & Sons	15
Baxter & Caunter	17	Sun Electrical Co., Ltd.	33
		Stern & Co.	136

THE SPRINGFIELD ELECTRIC MOTORS, LTD., Ings Mill, Guiseley.—The creditors interested herein were called together recently, at the Hotel Metropole, King Street, Leeds, when Mr. V. Walton, the liquidator in the voluntary liquidation, submitted a statement of affairs which showed liabilities of £4,243, made up as follows: Trade creditors, £1,545; loan accounts, £1,340; bankers, £1,208; and contingent liabilities,

had elapsed. After the first two days, the lights failed. Defendant renewed some of the wire on three occasions, but the same thing happened again. The premises had to be rewired at a cost of £17 10s.

Defendant said that he was an electrical contractor. He submitted three tenders, and eventually the third, amounting to £10 8s., was accepted. The wires were put in tubes, and these were inserted in the walls. The trouble arose through damp walls. He alleged that the plaintiff had said that he did not require a first-class job, but just wanted to pass the Corporation test.

The case was adjourned.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

The Court of Appeal, on April 15th, adjourned the hearing of the appeal of the British Insulated & Helsby Cables, Ltd., from the judgment of Mr. Justice Russell, until April 29th, when Sir Arthur Colefax, K.C., will continue his address on behalf of the B.T.H. Co. in support of the judgment of Mr. Justice Russell.

British Thomson-Houston Co. Litigation.

In the Chancery Division, on April 16th, Mr. Justice Eve, on the motion of Mr. Trevor Watson, for the British Thomson-Houston Co., Ltd., gave judgment in default of appearance and defence against Delmericks, of Uxbridge Road, W. Counsel said the action was to restrain infringement of letters patent. It was a case in which the patent had been upheld.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Employment in Australia.

In his letter under this heading in your current issue, "Anglo-Australian" makes the statement that the cost of living in Australia is generally conceded to be from 30 per cent. to 40 per cent. higher than in this country.

I wish to question this statement and to say that in my opinion any such disparity as may have existed in pre-war days has been wholly wiped out by the subsequent rise in prices here, with the result that to-day the cost of living is practically identical in both countries.

On the other hand, I confidently assert that as regards their general standard of living, including full employment, ample wages, moderate hours, comfort, recreation, ability to save, climate, and last, but not least, freedom from harassing political complications, Australians are far ahead of this or any other country, not excepting the United States.

I further consider that living as they do, in common with the rest of the Dominion peoples, under the protection of the Mother Country and contributing hardly anything to the immense standing cost of Imperial defence, the strenuous campaign they have been carrying on for some time past to secure further favours in the shape of preference in the home markets on certain of their foodstuff products is ill-conceived and ill-timed, as indeed Mr. Baldwin and the Conservative Party found out to their cost last December. The so-called preference which Australia loudly claims to be giving to British products is a gift horse, consisting as it does of merely a small percentage reduction in the excessively high scale of protective duties which she has imposed in order to shut out manufactured imports, whatever the country of origin, in pursuance of her policy of making herself industrially self-supporting.

Another Anglo-Australian.

April 14th, 1924.

Service Charges.

Can any of your readers inform me whether they have come across a more ridiculous charge than the one I have been asked to pay? The supply authorities have recently connected up some premises for me from their h.p. mains, and it required a total length of cable from the centre of pavement to the cellar of exactly 4 ft. For this long job I am charged the enormous sum of £5 as connecting fee, and on inquiry being made I am told that this is a general charge. Are supply authorities allowed to mulct the public to this extent? Having had experience with about ten supply companies and never having been asked in any similar instance for a charge, this you may well believe leaves me—

Beamless.

April 15th, 1924.

The Late Mr. George Hookham.

I should like to supplement the notice on page 586 of the Electrical Review, as it contains no reference to one of Mr. Hookham's most important achievements and the one by virtue of which he was most widely known both in the British Isles and all over the world. I refer to his great share in the production of the earliest electricity meters.

It was, I believe, about the year 1885 that Mr. Hookham first had his attention called to the need that would certainly arise within the next few years for a thoroughly reliable and reasonably cheap form of electricity meter, and it was in the year 1887 that his first meters were made. It was soon found that the earliest patterns were hardly suitable, but in 1891 Mr. Hookham took out his first patent for a meter consisting of a copper disk entirely submerged in mercury. This system was the basis of all his subsequent developments in the field of direct-current meters, and is the system adopted by all other makers of mercury motor meters.

The modern mercury motor meter may therefore be regarded as entirely due, at any rate in its inception, to Mr. Hookham's inventive skill and ingenuity.

S. H. Holden,
Chamberlain & Hookham, Ltd.

Birmingham, *April 16th*, 1924.

The Bellini-Tosi Radio Direction Finder.

I would like to suggest that the summary of the paper I read recently before the Wireless Section of the Institution of Electrical Engineers, printed in the Electrical Review of April 4th, under the heading "Bellini-Tosi Radio Direction Finders," gives in certain places an impression somewhat different from the actual text of the paper.

Lines 35 to 45 in particular give an impression that the subject is vague and the results uncertain. I would like to say that this is far from being the case.

John A. Slee,
Technical Manager,
The Marconi International Marine Communication Co., Ltd.

London, *April 16th*, 1924.

Squirrel-cage Motors of Over 5 h.p.

Mr. Lydall is in error in your issue of the 4th inst., and consequently it is his claim that is unique, and not the performance of the clutch.

My old clutch has frequently been set to come in *after* full speed has been reached. But it means extremely accurate governing.

A. E. Woodhouse.

London, *April 15th*, 1924.

The A.C. Commutator Motor and the Engineer's Education.

While in this country the demand for a.c. commutator motors is gradually increasing, owing to the appreciation of their inherent qualities which are vital to many industrial applications, I regret to notice a great lack of knowledge on this subject on the part of operating engineers.

This fact, which manufacturers know by direct contact with the labour market, can be traced directly to the lack of serious publications on the subject, and the lack of appreciation and understanding on the part of many technical teachers.

The advent of the induction-type motor, with exaggerated views with regard to its merits and simplicity, was responsible for the holding-up of progress on this class of machines, both from a designing and a manufacturing point of view.

The time has arrived, I believe, when these motors, at least for moderate sizes, could be of more general use, and unless the knowledge of their fundamental principles acquired by electrical engineers is widened, their progress will be hampered by doubts as to their satisfactory performance.

How many technical schools and universities have taken this subject seriously?

How many have got plant to experiment with and show to the students?

N. Pensabene-Perez.

London, *April 17th*, 1924.

The National Register of Electrical Installation Contractors.

A few weeks ago you were good enough to comment favourably in your journal on the inauguration of the National Register of Electrical Installation Contractors, for which I now take the opportunity of thanking you cordially. It will no doubt interest you to know that certificates of registration are now being issued to installation contractors who comply with the requirements of the body, and that applications for registration are being dealt with as rapidly as the necessary investigations make possible.

The National Register proposes to publish in your advertisement columns at an early date a first list of registered contractors under the headings of the respective towns or localities in which they carry on their businesses. The need of such a register is unquestioned, judging by the manner in which its establishment has been received, and by the absence of any unfavourable comment or criticism, and is evidenced by the stream of applications for registration which is steadily flowing in, and the inquiries which accompany these applications as to publication of the names of those applicants entered on the register and to whom certificates are

granted. May I ask you to bring to the notice of wiring contractors who have not yet sent in their applications, through your widely read columns, the advantage of doing so at the earliest moment if they desire their names to appear in the first list of Registered Installation Contractors entered on the register to be published, and to remind them that every application takes a certain amount of time for investigation before names can be passed by the Executive?

The fee payable on application covers registration until April 30th, 1925, when the Registered Contractors' Certificates become renewable. Applications should be addressed to the Secretary, 1, Lincoln's Inn Fields, London, W.C.2, who will supply application forms and answer any queries.

Inquiries as to the publication of lists of registered Installation Contractors are not confined to applicants for certificates and those to whom they have been granted, but are coming in from quarters in which lies the giving-out of wiring work, and the wish to comply with such an evidenced desire is the main reason for my asking for your kind offices, and the indulgence of your columns in reaching the interested parties concerned.

C. H. Wordingham,
Chairman,
National Register of Electrical Installation Contractors.

London, *April 19th*, 1924.

Radio Valves.

Would it be possible to prevail upon the principal valve manufacturers to mark the bulb or cap with the filament volts and amperes, and also the plate voltage?

If there are technical difficulties in the way, surely the cost of printing this information, together with the characteristic curve, either on the carton or as a leaflet to be packed with each valve, should not entirely absorb the margin of profit on an article which is retailed at from 12s. 6d. to 55s.

London, *April 17th*, 1924. **Valve.**

A Transmission Line Problem.

With reference to Mr. Lacey's article on "A Transmission Line Problem" in your issue of the 22nd ultimo, I herewith draw your attention to a few small errors which I am sure could be classified under the Printer's devils. The errors might have already drawn attention from someone in England by now; but I think it is never too late. They are:—

Page No. 284, second column, 12th line: "OB" should read as "OD."

Page No. 285, first column, 2nd line, and Page No. 285, second column, 21st line: "E" should read as "ER."

Simla, India, *March 31st*, 1924. **G. P. Ponday.**

Business Notes.

Bankruptcy Proceedings.—ARTHUR WILLIAM BOULD, 29, High Street, Skipton, Yorkshire, electrician.—The first meeting of the creditors herein was held on April 11th at the Official Receiver's Offices, 12, Duke Street, Bradford. According to the statement of affairs there were liabilities amounting to £467 and assets estimated to produce £71, leaving a deficiency of £395. Debtor attributed his failure to lack of trade, heavy overhead charges, and interest on borrowed money. The case being a summary one was left in the hands of the Official Receiver as trustee of the estate.

J. E. ELLIOTT & Co. (John Edward Elliott and James Mountjoy Elliott, trading as), 12, Broad Street, Oxford, electrical engineers.—An application for an order of discharge was made on April 16th to Mr. Registrar Hope, at the London Bankruptcy Court, on behalf of these bankrupts, who failed last September. The Official Receiver reported that the joint unsecured indebtedness amounted to £2,902, while the estate had realised £172. The Official Receiver gave particulars of the affairs and trading of the debtors as published in these columns at the time of their public examination, and added that they attributed their insolvency to depression in trade, to loss on contracts, to loss in consequence of the forced sale of their stock and office furniture by the sheriff, and to depreciation of the goodwill of their business. Trading and profit and loss accounts were prepared annually until December 31st, 1913, but not since, the reason for that given by the debtors being that they did not possess enough money with which to pay their accounts. They admitted that they knew that they were insolvent in August, 1920, and that they had since lost, over three contracts, sums amounting to £370 due to under-estimating. It further appeared that since then debts amounting to £1,910 had been contracted. As offences the Official Receiver submitted and reported that the debtors' assets were not of a value equal to 10s. in the £; that they had omitted to keep proper books of account; and that they had continued to trade with knowledge of insolvency. His Honour suspended the debtors' discharge for two years.

R. MCL. ALEXANDER (carrying on business with R. E. Hughes as R. E. Hughes and Hughes and Alexander), house furnisher and electrical and wireless engineer, 129, Brockley Rise, S.E., and 51, Honor Oak Park, S.E.—Discharge granted subject to debtor's consenting to judgment being entered against him for £5.

W. J. DICKEN (W. Dicken & Son), electrical engineer, 2, High Street, Bargoed.—First and final dividend of 8¾d. in the £ payable April 25th at the Official Receiver's office, 34, Park Place, Cardiff.

C. K. WALLIS, electrical engineer, late of Bedford Street and Longford Road, Bognor.—First meeting April 29th, at the Official Receiver's offices, 12a, Marlborough Place, Brighton. Public examination May 7th, at the Court House, Brighton.

W. E. WEEKS, wholesale electrical dealer, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol.—Last day for proofs for dividend May 2nd. Trustee, Mr. J. P. Emett, 18, Nicholas Street, Bristol.

J. H. WHITEHOUSE, electrical engineer, 61, Martin Street, Morriston, Swansea.—First and final dividend of 3¼d. in the £, payable May 28th, at the Official Receiver's offices, Government Buildings, St. Mary's Street, Swansea.

AUBREY VICTOR CLAYTON, 7, Woodhouse Square, Leeds, carrying on business at Park Lane Mills, Chorley Lane, Leeds, as an engineer, under the style of "Clayton Motors."—A first and final dividend is to be declared in this matter. The liabilities as per debtor's statement of affairs were £6,412, and the estimated amount available for dividend is £50. Mr. H. Clifford Bowling, Official Receiver and Trustee, 24, Bond Street, Leeds.

T. G. H. WILEY (Wiley & Co.), electrical engineer, late of Cemetery Road, Pudsey, and Oxford Place, Stanningley, Yorks.—First and final dividend of 6d. in the £, payable at the Official Receiver's office, 12, Duke Street, Bradford.

Company Liquidations.—BRITISH RADIO SALES CO., LTD.—A petition for the winding up of this company has been presented by the British Broadcasting Co., Ltd., of 2, Savoy Hill, W.C., and will be heard in London on April 29th.

G. H. TURNER & Co., LTD., 101, High Street, Harlesden, London, N.W., and Cross Street, London, E.C., electrical contractors, &c.—The creditors interested herein were called together recently, when Mr. P. M. Harper, I.A., of 329, High Holborn, W.C., submitted a statement of affairs which showed gross liabilities of £2,472, made up as follows: Debenture-holders, £695; cash creditors, £319; trade creditors, £1,038; expense creditors for rent, light and power, £359; and apprentices' premiums, unexpired, £60. The total assets were £2,118, or a deficiency of £354.

The Liquidator (Mr. Harper) reported that the company was registered on October 28th, 1912, with a nominal capital of £1,500, of which £1,052 had been issued and was fully paid. On November 6th, 1912, debentures for £350 were issued, but half that issue was subsequently repaid. On March 17th, 1915, second debentures for £500 were issued, and were still outstanding. Early in 1917 the debenture-holders appointed Mr. Turner to act as receiver on the ground that their security was in jeopardy. Mr. Turner had acted as receiver and manager ever since. The company went into voluntary liquidation on March 29th of the present year, when Mr. Turner's appointment as receiver was terminated, the idea being that the liquidator should also act as receiver. The present position had been largely brought about owing to the ill-health of Mr. Turner, and so far as could be seen there had been every endeavour made to finance and carry on the business. During last year the debenture-holders found a further £300 for the company without security. The excess of unproductive wages had also contributed to the present position. Some of the work in progress had been completed since the liquidation took place, but the premises had now been closed down. It was proposed to realise the remaining assets. There was a probability of the assets being increased by £90 or £100, representing a refund of income tax.

After a lengthy discussion a resolution was passed in favour of the meeting being adjourned with a view to the debenture-holders being approached to see whether they would agree to rank as unsecured creditors in respect of their claims.

The following are creditors:—

	£		£
Callender's Cable & Construction Co.	18	Calmont, King & Co.	24
Hall & Brenard, Ltd.	22	Cox & Edwards	46
Leverett & Co.	24	Edison Swan Electric Co., Ltd.	55
Chafer Bros. & Bury	75	Falk, Stadelmann & Co.	142
J. & W. B. Smith	204	General Electric Co., Ltd.	27
Credenda Conduits, Ltd.	40	Perrett & Sons	15
Baxter & Caunter	17	Sun Electrical Co., Ltd.	33
		Stern & Co.	136

THE SPRINGFIELD ELECTRIC MOTORS, LTD., Ings Mill, Guiseley.—The creditors interested herein were called together recently, at the Hotel Metropole, King Street, Leeds, when Mr. V. Walton, the liquidator in the voluntary liquidation, submitted a statement of affairs which showed liabilities of £4,243, made up as follows: Trade creditors, £1,545; loan accounts, £1,340; bankers, £1,208; and contingent liabilities,

£150. The assets were estimated to realise £3,350, from which had to be deducted £459 for preferential claims, leaving net assets of £2,891, or a deficiency of £1,351. The claims of the fully-secured creditors totalled £2,097, and they held securities valued at £4,282. The company was registered on September 3rd, 1923, and took over an existing business which had previously been carried on in partnership. The consideration payable for the assets acquired by the company was the sum of £4,300, which was discharged by the allotment to the vendors of fully-paid shares. No balance sheet had been prepared since the incorporation of the company, but a trading account had been got out covering the period from October 28th, 1923, to March 22nd last, and it showed a gross loss of £1,360, the turnover only being £910. The net loss for the five months was £2,600. The creditors decided to confirm the voluntary liquidation of the company, subject to a supervision order being obtained from the Court.

Brown & Co. (Loton), Ltd., motor and electrical engineers, Renshaw Street, Liverpool.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of creditors was held recently in Liverpool, when the chair was taken by the liquidator, Mr. Bryce M. Hanmer. A statement of affairs was presented, which disclosed liabilities of £13,338, made up as follows: Loans and interest, £6,450; bankers, £1,989; trade creditors, £4,501; and sundry creditors, £399. There was also a fully secured creditor for £84, who held security valued at £150, leaving a surplus of £66. The total assets were £12,276, from which had to be deducted £178 for preferential claims, leaving net assets of £12,097, or a deficiency of £1,241. The present position was attributed to insufficient capital, carrying too heavy a stock, trade depression, and other causes. The creditors decided to confirm the voluntary liquidation of the company, with Mr. Hanmer as liquidator, and a committee of inspection was also appointed. The following are creditors:

	£		£
Dunlop Rubber Co., Ltd. ...	129	Pyreen Co., Ltd.	58
Eastham Machinery Screw Co.	57	Rapson Tyre Co.	167
Guiterman, S., & Co.	200	Robinhood Engineering Works	65
General Electric Co., Ltd. ...	115	Sphinx Spark Plug Co. ...	67
Hill, E. H., Ltd.	1,400	Vacuum Oil Co.	134
Lake & Elliott, Ltd.	392	Matchett, R.	92
Lodge Plug Co.	130	Iliffe & Sons	86
Lucas, Jos., Ltd.	68	Bryce Hanmer & Co.	174
Michelin Tyre Co.	64		

Re-Echo Electrical Manufacturing Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. F. Richards, 43, Johnson Street, Westminster, S.W. Meeting of creditors April 28th, at the company's office, particulars of claims to the Liquidator by June 9th. A petition for the winding up of this company has been presented by the British Broadcasting Co., Ltd., of 2, Savoy Hill, W.C., and will be heard in London on April 29th.

Cox-Cavendish Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. J. Blackadder, Norfolk House, Norfolk Street, W.C. A meeting of creditors was called for April 24th at Donington House, 30, Norfolk Street, W.C.2.

Radio Service Co., Ltd.—A meeting of members is called for May 20th, at 60, Chancery Lane, W.C., to hear an account of the winding up from the Liquidator, Mr. M. Hyams.

Consolidated Electrical Company, Ltd.—Winding up voluntarily. Liquidator: Mr. H. W. West, 236, Mansion House Chambers, Queen Victoria Street, E.C. Meeting of creditors was to be held on April 24th, at the offices of the liquidator. Particulars of claims by May 15th.

Remco Carbon Co., Ltd.—A meeting of members is called for May 20th at 46-47, London Wall, E.C., to hear an account of the winding-up from the Liquidator, Mr. R. Crane.

Connolly Bros., Ltd.—The liquidators' summary of accounts from July 2nd, 1923, to January 1st, 1924, is as follows: Receipts: Balance, £16,736. Payments: Total costs and charges, £400; unsecured creditors' first dividend of 12s. 6d. in the £ on £18,727=£11,704; balance, £4,631.

Accumulator Industries, Ltd.—By an order of the High Court dated April 8th, Mr. A. W. Sully, of 19 and 21, Queen Victoria Street, E.C., has been appointed sole liquidator of the above company in the voluntary winding-up.

Private Arrangements.—Thomas Hudson Hunter and Joseph Godfrey Ogle, electrical engineers, trading as Hunter, Ogle & Co., 174, Corporation Street, Birmingham.—In response to a circular letter issued by Messrs. Brookes, Monk and Hargreave, solicitors, 37, Waterloo Street, Birmingham, a meeting of the creditors of the above was held recently, at the Chamber of Commerce, New Street, Birmingham. A statement of affairs was presented, which had been prepared by Messrs. Corfield & Cripwell, of 12, Cherry Street, Birmingham, which disclosed liabilities of £4,830, of which £2,558 was due to the trade and £2,272 to cash creditors. The assets were estimated to realise £1,812, from which had to be deducted £138 for preferential claims, leaving net assets of £1,673, or a deficiency of £3,157. The separate estate of Mr. Hunter showed a surplus of £348, whilst that of his partner showed a surplus of £23.

It was reported that the debtors commenced business in March, 1919. They had previously been with the B.T.H. Co. At the outset they had little or no capital of their own, but £500 was borrowed and subsequently repaid. During 1919-20 there was a trading profit of £813, whilst in the following 12 months the turnover was £8,437, with a gross profit of £1,534, whilst commissions were earned to the extent of £3,484, and there was a net profit of £3,875. During 1921-22 the turnover fell to £4,800, whilst the commissions earned were £1,842, and the result of the trading was a net profit of £123, and the drawings totalled £1,913. In the following twelve months the turnover increased to £8,132, while the commissions earned totalled £1,716, but the net profit was only £39, and the joint drawings were £1,462. For the past twelve months the turnover had been £8,400, with a gross profit of £1,242. The commissions earned during the period were £824, whilst the net profit was £215, and the total drawings were £1,423. Both the debtors were men of considerable experience in the trade, and they had held good agencies, but the expenses of the business had been heavy.

On behalf of the debtors an offer was made of a composition of 10s. in the £, payable as to 5s. in three months, 2s. 6d. in six months, and 2s. 6d. in nine months. A resolution was unanimously passed accepting the offer, which it was stated would be secured by the execution of a deed to Mr. W. Hands, of Messrs. Corfield & Cripwell, whilst the cash creditors for £2,271 would stand aside. A committee was also appointed consisting of the representatives of Messrs. Ennis & Riddle, S. Bill & Co., and Poppleton & Appleby.

Trade Announcements.—Messrs. Long & Crawford, Ltd., manufacturers of switchgear, of 2, Gorton Road, West Gorton, Manchester, have appointed Mr. Thos. T. D. Geesin, of 4, Clevedon Road, Penge, S.E.20, as their representative for the London district.

Princess Mary visited the galleries of Messrs. F. & C. Osler, Ltd., at 100, Oxford Street, recently, and purchased fittings for her Yorkshire residence, Goldsborough Hall.

The Stella Conduit Co., Ltd., of Bilston, has appointed the Brighton Electric Supply Stores, 38, Gloucester Road, Brighton, as its agents for Brighton and the South-East Coast.

Messrs. Drake & Gorham, 36, Grosvenor Gardens, W., have taken over the representation for the electrical trade in Ireland of "Glasgow" single sleeve valve engine and lighting sets made by Messrs. Wallace (Glasgow), Ltd.

The Consolidated Pneumatic Tool Co., Ltd., has removed its Leeds office to 67, St. Paul's Street, Leeds.

Messrs. Crow, Toogood & Co., of London, Bournemouth, and Plymouth, have been appointed sole selling agents for Messrs. Reeves & Co., Birmingham (electrical accessories) for the counties of Hants, Dorset, Devon, and Cornwall.

The address of Messrs. Catchpole & Co. has been changed to Components House, 25, Eccleston Street, corner of Ebury Street, London, S.W.1.

Messrs. Simmonds & Stokes, Ltd., of 4, Vernon Place, Southampton Row, London, W.C.1, have purchased the electrical business of Simmonds Bros., Ltd., Newton Street, W.C. (Niphan couplings), and are continuing it without change, but all correspondence should be addressed to them.

Catalogues and Lists.—Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, W.C.1.—A coloured poster advertising the "Lyrianette" receiving set, and also a pamphlet giving prices and details of this set.

Messrs. Watson & Sons (Electro-Medical), Ltd., 43, Parker Street, Kingsway, W.C.2.—A list of revised prices of intensifying screens, for use with Bulletin No. 58s.

The Dowson & Mason Gas Plant Co., Ltd., Levenshulme, Manchester.—An illustrated booklet dealing with oil pumping and measuring equipment.

Messrs. D. H. Bonella & Son, Ltd., 46-48, Osnaburgh Street, Euston Road, N.W.1.—An illustrated and priced folder advertising radio crystal receiving sets, components, and accessories.

The British Central Electric Co., Ltd., 6 & 8, Rosebery Avenue, E.C.1.—A price list of cables and flexibles of all kinds.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—Pamphlets dealing with the "Glassteel" lighting diffuser and B.T.H. electric fans. Illustrated and priced. Also a mailing card bearing illustrations of "Radiola" receiving sets and accessories.

Messrs. Hart, Collins, Ltd., 38a, Bessborough Street, Westminster, S.W.1.—Illustrated and priced catalogue containing very full details of "Hart, Collins" wireless receivers.

Messrs. Henry Simon, Ltd., 20, Mount Street, Manchester. —A well-illustrated brochure dealing with coal handling by suction methods.

The Ray Engineering Co., 24, Frogmore Street, Bristol.—An illustrated and priced pamphlet containing particulars of the firm's battery-charging switchboards.

Electric Equipment Manufacturers Pty., Ltd., Normanby Road, South Melbourne (Vic.).—A series of illustrated pamphlets dealing with the company's e.h.p. switchgear, outdoor sub-stations, &c.

Burwood Electrical Supplies Co., 1924, of 41, Great Queen Street, Kingsway, W.C.2.—A price list of crystal and valve receiving sets, components, and accessories.

For Sale.—Messrs. George Cohen and Armstrong Disposal Corporation invite offers for plant, machinery, &c., including electric motors and electrical material at the Southampton depôt.

By order of Messrs. May & Butcher, Ltd., owing to reconstruction of business, Messrs. Henry Butcher & Co. will sell by auction on May 6th and following days at Heybridge Basin, Maldon, Essex, plant, machinery, &c., including a 220-V d.c. electric power plant, three 40-kW generator sets and switchgear, pumping sets, cranes, &c. (See our advertisement pages to-day.)

Book Notices.—"Engineering Abstracts"—New Series—No. 19. April, 1924. London: The Institution of Civil Engineers.

Publications of the United States Bureau of Standards. Technologic Papers Nos. 246, "Wet-Process Enamels for Cast Iron" (10 cents); 247, "A New Electrical Telemeter" (15 cents); 248, "Exposure Tests on Colourless Waterproofing Materials" (15 cents); and 249, "Thermal-Conductivity Method for the Analysis of Gases" (20 cents). Circulars Nos. 10, "Legal Weights (in Pounds) per Bushel of Various Commodities" (5 cents); 136, "Specification for Numbered Cotton Duck" (5 cents); 149, "A Standardised Method of Measuring the Size of Hosiery" (5 cents); 752, "Specification for Ceramic Whiting" (5 cents); 478, "Redetermination of Secondary Standards of Wavelength from the New International Iron Arc" (5 cents); 479, "Interferometer Measurements of the Longer Waves in the Iron Arc Spectrum" (5 cents); and 481, "Measurement of Low Resistance by means of the Wheatstone Bridge" (5 cents). Washington: Government Printing Office.

The Lancashire United Tramways, Ltd., has sent us a copy of its booklet, "Touring by Motor Coach" (price 6d.).—This is a well-illustrated guide to a wide area embracing the Lake District, Cheshire, North Wales, &c.

"Code of Ethics of the Electric Power Club" (pp. 8). Cleveland, Ohio: The Electric Power Club.—This booklet sets standards for the conduct of members in a concise manner. The code is divided into four sections, dealing, respectively, with general principles, relations of manufacturers to customers, agents or others; general relations of manufacturers to each other; and relations of manufacturers to each other in selling.

"*Journal* of the Institution of Electrical Engineers." Vol. LXII. No. 328. April, 1924. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The issue for April contains the following papers:—"Theoretical and Experimental study of the Electric Field in an Electrolytic Cell," by Mr. A. A. Ahmed; "Railway Electrification in Foreign Countries," by Dr. S. P. Smith; "Electric Passenger Lifts," by Mr. H. Marryat; and "Atmospherics and their effect on Wireless Receivers," by Mr. E. B. Moullin.

"Electricity and its Application to Automotive Vehicles," by P. McD. Stone. Pp. xvi+844; 395 figs. London: Geo. Allen & Unwin, Ltd. Price 18s. net.

"Electrical Vibration Instruments," by A. E. Kennelly. Pp. x+450; figs. 214. London: Macmillan & Co., Ltd. Price 30s. net.

U.S. Electrical Exports for February.—Preliminary figures of the Department of Commerce for February show that 6,826,792 dollars' worth of electrical machinery, apparatus and supplies were exported to foreign markets during the month, the value of export shipments during the same month of 1923 being 4,645,614 dollars. The excess over 1923 during the first two months of the year is thus extended to approximately 3,800,000 dollars. A tendency toward increased exports of appliances, rather than of heavy electrical apparatus, is noticeable so far during 1924, which may be an indication of a wider distribution of this export trade among smaller United States manufacturers. The gain is distributed throughout all classes, the most noteworthy increases being in exports of radio apparatus, electric railway motors, and watt-hour and other measuring meters. Shipments of self-contained lighting outfits almost doubled, and exports of storage batteries were also heavy.—*Reuter's Trade Service* (Washington).

Chloride Telephone Batteries.—The General Post Office has just placed further orders with the Chloride Electrical Storage Co., Ltd., for a series of batteries for various telephone exchanges. They include the following:—Two 810-Ah batteries for Cheltenham, two of 10,000-Ah for Holborn, two of 10,000-Ah for Bishopsgate, two of 650-Ah for Oxford, one of 180-Ah for Woodhouse, one of 180-Ah for Ecclesfield, and the following batteries for the Sheffield exchange, namely, two of 3,600, two of 700, two of 360, and two of 300-Ah capacity. The Chloride Electrical Storage Co., Ltd., is also executing an order for what we understand is the largest telephone battery in India, *i.e.*, that for the Bombay exchange.

New Australian Company.—A new company has lately been formed in Adelaide (86-88, Brookman's Buildings, Grenfell Street) with a capital of £20,000, and the title The Clare Electric Supply Co., Ltd., to establish a plant to supply the towns of Clare and Blyth with electricity for lighting and power purposes.

German Purchase of Norwegian Zinc Works.—It is reported from Fredriksstad that the local government board of Borge has unanimously decided to recommend the granting of permission for the sale of the Sundlokken zinc works in Borge to the firm of Beer, Sondheimer & Co., of Frankfort-on-Main, who have offered to take over the majority of the shares in the A.S. Norsk Elektrisk Metalindustri, of Sundlokken, including the fixed property and the contract for the lease of electrical power from the Hafslund Co. The purchase price is 4,250,000 kronen, and but few shares will remain in Norwegian hands. It is stated that the German company was formerly the chief owner of the zinc works through being the principal shareholder in the Van Derie company of the Société Anon. Metallurgique, Procédés de Laval, of Brussels, which in 1905 acquired the electric smelting works in Sundlokken from the Swedish engineer de Laval. It is said that the new owners will expend about 2,500,000 kr. in extending the plant. The transfer of the concession is dependent upon the consent of the Government, whose water-power administration now has the matter under consideration.

German Electrical Industry During March.—The Commercial Secretary at Berlin (Mr. J. W. F. Thelwall) states that the Berlin Chamber of Commerce reports that business continued active and, in part, became more lively. Tramways and light railways were in a more favourable position as a result of the stabilisation of the mark, and began to place orders once more. Orders from industrial railways were also booked, but, as regards standard-gauge electric railways, no orders of any importance were received. In the telegraphic and telephonic line several orders were placed by the Reich Post and Railways.

Sydney Electrical Contracts.—A number of Australian newspapers have reached us this week containing reports of an inquiry which was held at Sydney on March 7th, when evidence was given before a committee which had been appointed to inquire into cases of alleged collusion among electrical tenderers to the Sydney City Council. We quote the following report from the *Industrial Australian and Mining Standard*:—"Mr. W. R. Caithness, the Australian representative of the British General Electric Co., Ltd., speaking for and on behalf of the English Electrical Co. of Australia, Ltd., Metropolitan-Vickers Electrical Co., Ltd., Australian General Electrical Co., Ltd., and John Adams & Co., Ltd., stated 'that we as contractors have been in the habit of adding a certain amount to the City Council tenders. Speaking generally, we candidly admit that has been done. We are prepared to admit it was done up to the time Mr. Suttor left the British General Electric Co., but that it has not been done since.' There were, Mr. Caithness continued, a large number of firms in the electrical business in Australia, and, compared with the business in Great Britain or America, the amount of business for these firms in Australia was very small. The firms had to maintain large and expensive technical staffs in Australia for the purpose of preparing specifications and generally for the purpose of advising customers. The services of these experts were always available for the benefit of purchasers. There was a good deal of technical work done for schemes that were never carried out. That meant that the working expenses of the individual firms were very heavy, and they felt that they had to recoup themselves for this outlay in some way, and the custom was fairly generally recognised of adding a percentage amount to certain tenders for the purpose of distribution by the successful tenderers amongst those who were unsuccessful. The scheme was regarded as an ordinary business transaction, and the City Council would find by investigating its prices that under this system it did not pay any more for its material and equipment than was payable to other similar firms in America and Great Britain when all the facts and circumstances were taken into consideration. 'We are,' concluded Mr. Caithness, 'prepared to give the City Council an assurance that we will not continue this particular system in tendering for City Council supplies, but I would also add that the contracting firms will have to protect themselves, and none of us can live on air.'"

Recent Contracts.—The Admiralty has recently placed orders for electric lamps with the Metropolitan-Vickers Electrical Co., Ltd., the Edison Swan Electrical Co., Ltd., and the Siemens & English Electric Lamp Co., Ltd. The last firm has also received a large order for traction-type lamps from the London Electric Railway Co. THE GENERAL ELECTRIC CO., LTD., has received large orders for Osram lamps from the Salford Tramway Department and the Port of London Authority.

Crewe Railway Works to be Electrified.—Speaking at the recent annual meeting of the Salt Union, Ltd., the chairman stated that the Mersey Power Co., Ltd., was about to conclude a contract for the supply of from 10 to 20 million kWh of electricity to the Crewe railway works of the L.M. & S. Railway. The latter had for some time been anxious for the supply, but difficulties had arisen through the fact that Crewe was included by the Electricity Commissioners in the North Wales Power Co.'s area, which concern was not in a position to supply any current to the Crewe works. At the request of the Commissioners it has been arranged that the Mersey Co. shall not supply the Crewe works direct, but through the North Wales Co.

Unemployment.—There was a decrease of 14,073 in the total number of registered unemployed during the week ended April 7th, the figure on that date being 1,044,700. The reduction since the beginning of the year was 241,420.

Tramway Employés' Wages.—A national delegate conference is to be held in Manchester on May 1st to consider the question of tramway employés' wages. The *Daily Herald* states that demands for increases ranging from 5s. to 9s. per week made by tramwaymen in Lincoln and Yorkshire have been referred to the conference.

"Buy British Goods."—The proposed campaign of the Federation of British Industries is to be postponed until a more propitious time in view of the large expenditure which many firms are making at the British Empire Exhibition.

Successful G.E.C. Claim.—It is announced that the General Electric Co., Ltd., has been successful in its claim for £300,000 which came before the Anglo-German Mixed Arbitral Tribunal recently. This will materially strengthen the company's investment account and reserves.

E.D.A. Activities.—The latest publication of the British Electrical Development Association is a card (E.D.A. No. 427) bearing an illustration of a burning cigarette and the statement, "Electricity reduces fire risk: smoking doesn't!"

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month of the dates mentioned. In the case of foreign applications the name and address of the British representative are also given:—

Mumetal. No. 445,912. Class 5.—Metallic alloys, unwrought or partly wrought. The Telegraph Construction & Maintenance Co., Ltd., London, E.C.2. April 16th, 1924.

Gambrellite. No. 435,481. Class 8.—Crystals for use in wireless telephony. Gambrell Bros., Ltd., Wandsworth, S.W.18. April 16th, 1924.

C.S. Radio (lettering and design). No. 445,387. Class 8.—Philosophical and scientific instruments, &c. Cunningham, Slater, Ltd., 146, Kensington High Street, London, W.8. April 16th, 1924.

Cordesia. No. 445,197. Class 8.—Galvanic batteries and accumulators, instruments, and apparatus for wireless telegraphy and telephony. Heinrich Cordes and Hermann Branz, 11, Ritterstrasse, Berlin, S.42. (Frank B. Dehn, 53, Doughty Street, London, W.C.1.) April 16th, 1924.

Argentone. No. 445,384. All goods in Class 8.—T. W. Young, Ltd., 84-86, City Road, London, E.C.1. April 16th, 1924.

Selmos Radio, Sound Always True (lettering and design). No. 444,684. Class 8.—Apparatus to be used in wireless telegraphy and telephony. Emanuel Simons, 100-101, Houndsditch, London, E.1. April 16th, 1924.

Avometer. No. 446,266. All goods in Class 8.—The Automatic Coil Winder & Electrical Equipment Co., Ltd., Wellington House, Buckingham Gate, London, S.W.1. April 16th, 1924.

Holrose. No. 445,810. Class 8.—Apparatus for use in wireless telegraphy and telephony. Charles A. Holland, 43, Lonsdale Road, Kilburn, N.W.6. April 16th, 1924.

Imp (lettering and design). No. 445,454. Class 11.—An electrical heel pad (not medicated) for use in relation to the health. Electropeds, Ltd., 29, Ludgate Hill, London, E.C.4. April 16th, 1924.

Ferrow. No. 442,358. Class 13.—Electric lamps (ordinary). The Anglo-Austrian Electric Lamp Works, Ltd., London, W.C.2. April 16th, 1924.

Wootophone. No. 445,394. Class 13.—Electric terminals, switches, &c., for use in wireless telegraphic and telephonic apparatus. F. E. Wootten, Ltd., 55, High Street, Oxford. April 16th, 1924.

The German Siemens Companies.—Although so far as the figures go, the leading electrical engineering concerns in Germany made considerably greater profits last year than in 1922, it would appear that the financial position is not so strong, as in two important instances the directors have decided not to declare a dividend, but to carry the amount forward to the current year. Thus, the Siemens & Halske Gesellschaft, of Berlin, reports a net profit of 95,025,703,581,845 marks for the year ending September 30th last, as compared with only 158,245,336 marks in 1922, when a dividend of 80 per cent. was paid on a capital of 130,000,000 marks. The other concern is the Siemens-Schuckertwerke Gesellschaft, of Berlin, which for the same financial period reports a net profit of 80,892,604,023,165 marks, as against only 109,393,712 marks in 1922, when a dividend of 80 per cent. was paid on a capital of 90,000,000 marks.

Copper and Lead Prices.—Messrs. F. Smith & Co. report April 23rd:—Copper (electrolytic) bars, £70 15s., 5s. increase; do. do. sheets, no change; do. do. wire rods, £80 15s., 5s. increase; do. do. h.c. wire, no change.

Messrs. James & Shakespeare report April 23rd:—Copper bars (best selected), sheet and rod, no change; English pig lead, £34, 25s. increase.

Lighting and Power Notes.

Brynamman.—Special Order.—The Brynamman and District Electric Supply Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the Urban District of Cwmamman and parts of the parishes of Llandilo Fawr Rural and Quarter Bach, in the county of Carmarthen, and part of the parish of Llanguick, in the county of Glamorgan.

Canada.—Hydro-Electric Development.—Final approval of the plans of the British Columbia Electric Railway Company for its Alouette Lake development has been given by the provincial government of British Columbia. A tunnel is to be constructed from Alouette Lake to Stave Lake, a distance of 4,000 ft., a dam constructed at the lower end of Alouette Lake, and a power house of 11,500 h.p. built at the end of the tunnel, using the difference in level of the two lakes of 140 ft. In addition, the present Stave Falls plant, which has a capacity of 52,000 h.p., is being enlarged this year by rewinding the present four sets and installing a fifth, bringing the capacity up to 70,000 h.p. These two schemes will be completed by the end of 1925 and will cost $3,250,000. Eventually a third plant at Ruskin, 3½ miles down the Stave River, will be built with a capacity of 96,000 h.p. The estimated total cost of the schemes is $10,000,000.—*Electrical World*.

The announcement has been made in the Legislature by the Premier that the Government proposes to develop the water-power at Grand Falls on the St. John River. It is the present intention to develop power to be stored on purely Canadian territory, which is estimated at from 60,000 to 80,000 h.p. The St. John River is an international stream, being a portion of the boundary between the State of Maine and New Brunswick.—*Reuter's Trade Service* (St. John, N.B.)

Callander.—Electricity Supply.—A committee of the Town Council is considering a scheme for the introduction of electric light in the district. A water-power scheme is favoured.

Continental.—Italy.—A convention has been signed between the administration of the Italian State railways, the province of Alessandria, and the Inter-regional Electrical Co., for the utilisation of the River Borbera. The last authority undertakes to construct works and a reservoir with a capacity of 150,000,000 cu. m., with a dam 80 metres high. It is estimated that the works will be able to yield annually 86,000,000 kWh, of which 60,000,000 kWh would be reserved for the State in connection with the working of the trunk lines between Milan and Genoa and Genoa and Pisa. All the works are to be completed in seven years, and the total expenditure is estimated at over 100,000,000 lire.

Belgium.—In order to meet the increasing demand for electricity, the Société de Gaz et d'Electricité du Hainaut has decided to install an additional generating set at each of its three stations, which will increase the total capacity of the plant from 52,800 to 67,100 kW.

Bavaria.—The Bayernwerke have recently been put into service. These works consist of a system of electrical distribution which, intended originally for the supply of Lower Bavaria only, is gradually extending over the whole of South Germany. The annual production will probably be about 1,000 million kWh at the outset. Other hydro-electric works constructed later in Bavaria will probably be linked up with the Bayernwerke, which will extend their system in proportion to the demand for power and the increase in their production capacity. By this method one establishment will be able to centralise the whole of the production and distribution of electric energy in South Germany.—*Reuter's Trade Service* (Berlin).

East Suffolk.—Special Order.—The Orford Electric Light and Power Co. has applied to the Electricity Commissioners for a Special Order authorising it to generate and distribute electricity within the Urban Districts of Leiston-cum-Sizewell, Saxmundham, and Woodbridge and certain parishes in the Rural Districts of Blything, Plomesgate, and Woodbridge.

Harwich.—Electricity Supply.—The Electric Lighting Committee reports that the agreement between the London and North-Eastern Railway and the Corporation for the supply of electricity in bulk at Parkeston Road, Dovercourt railway station, Harwich pumping station and Harwich railway station, has been approved by the Electricity Commissioners, and that application has been made to the Electricity Commissioners for sanction to borrow £27,578 and to the Unemployment Grants Committee for a grant in respect of the outlay involved in the installation.

Heywood.—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to borrow £10,000 for extension of e.h.p. mains to provide an alternative route for the bulk supply from Bury Corporation, *via* Heap Bridge, to Foundry Street, with an extension to Hooley Bridge.

Irish Free State.—Dublin.—The Lord Mayor of Dublin has convened a public meeting to be held in the Mansion House on May 12th to consider a resolution approving the promotion of a Bill by the Corporation to amend and extend the powers of the Dublin Corporation under the Electric Lighting Acts by authorising it (1) to utilise the water power of the River Liffey for the generation of electricity; (2) to acquire necessary land and buildings, to construct dams, reservoirs, and generating stations, and to use and provide all necessary machinery, transforming stations, transmission lines, distributing stations, &c.; (3) to supply electricity to other local authorities, companies, bodies, and persons in the adjoining counties of Dublin, Wicklow, and Kildare; (4) and to borrow money required for the carrying-out of the undertakings proposed.

Newry.—The Urban District Council has instructed Mr. P. A. Spalding, manager of Dundalk municipal electricity undertaking, to prepare a scheme of electric lighting for the district.

Howth (Co. Dublin).—A public lighting scheme was recently inaugurated.

Inverness.—ELECTRICITY SUPPLY.—The Town Council has secured the services of Mr. W. Blair Smith, electrical engineer of Paisley, to advise it in connection with the preliminary negotiations with Edmundsons' Corporation regarding the electricity undertaking.

Menai Bridge (North Wales).—STREET LIGHTING.—The Urban District Council has decided to substitute electricity for gas for public lighting.

Middlesbrough.—ELECTRICITY SUPPLY.—In connection with the proposal to extend the Corporation's area of electricity supply to Nunthorpe, a canvass of the residents has proved satisfactory, and the Town Clerk is negotiating for wayleaves and for sites for two sub-stations.

LOAN.—Application is to be made to the Electricity Commissioners for sanction to the borrowing of £11,500 for the change-over to a.c. in the Southfield Road-Corporation Road area.

Northwich.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Northwich Electric Supply Co., Ltd., to supply electricity within the Urban Districts of Knutsford, Middlewich, and Winsford and parts of the Rural Districts of Northwich and Bucklow.

Norwich.—NEW POWER STATION.—An expenditure of £250,000 has been sanctioned by the City Council for the erection of a new power station, which it is hoped to have in full running order in about 18 months' time.

Plymouth.—LOAN.—The Electricity Committee has decided to make application to the Electricity Commissioners for sanction to borrow £10,630 for laying new feeder cables and distributing mains.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

HACKNEY.—Scale A: Alternative No. 1 (lighting) from 60s. to 50s. per kW per quarter, the energy charge remaining at 1d. per kWh; alternative No. 2 (lighting), flat rate from 5½d. to 5d. per kWh. Scale B: Alternative No. 1 (power) from 30s. to 25s. per kW per quarter, the energy charge remaining at ¾d. per kWh; alternative No. 2 (power), flat rate from 2d. to 1½d. per kWh.

ILFORD.—Residential premises: Electricity consumed for any domestic purpose, primary charge, 15 per cent. per annum on rateable value, plus ¾d. per kWh for the summer quarters and 1d. per kWh for the winter quarters. Lighting: Flat rate, 5d. per kWh; 10,000 kWh and over per quarter, 4½d. Maximum demand rate: For the equivalent of one hour's use of maximum demand per day, 8d. per kWh; beyond, 1½d. per kWh. Power: Maximum demand rate, 3d. and 1d. per kWh. Sliding scale: First 500 kWh per quarter, 2½d. per kWh; next 1,000, 2d. per kWh; over 1,500, 1½d. per kWh; 10,000 or over, 1½d. per kWh. Heating or cooking: Summer quarters, 1d. per kWh; winter quarters, 1½d. per kWh. Minimum payment for each meter installed, 5s. per quarter.

NORTHAMPTON.—*The Northampton Electric Light and Power Co., Ltd.*—Heating and cooking: 1d. per kWh. Domestic boilers: ¼d. per kWh, less 5 per cent. cash discount.

HALESOWEN:—*The Halesowen Lighting & Traction Co., Ltd.*—Lighting: Ordinary rate, 6d. per kWh. Inclusive residential tariff, up to four rooms a fixed charge of 10s. per quarter, and 2s. 6d. per quarter for each additional room, with 3½d. per kWh for the first 10 kWh per room per quarter, and 1½d. per kWh beyond. Long-hour lighting of business premises: First 90 kWh per kW of maximum demand per quarter, 8d. per kWh, and 3d. per kWh beyond, with a minimum charge of £20 per annum. Factory lighting: First 1,000 kWh per quarter, 3½d. per kWh, beyond, 3¼d. Outside sign lighting, 3d. per kWh. Power: Up to 300 kWh per quarter, 2½d.; 300 to 5,000, 2d. per kWh, next 5,000, 1½d. per kWh, beyond, 1¼d. per kWh. Heating and other domestic supplies, 2d. per kWh.

Retford.—ELECTRICITY SUPPLY.—The Town Council, having been advised by Mr. Seabrook that the cheapest system of generating electricity is from the gas works, has decided to establish its own undertaking.

Slaithwaite.—ELECTRICITY SUPPLY.—The Urban District Council has reached an agreement with the Yorkshire Electric Power Co. for a bulk supply for 25 years, coming into operation on a date not earlier than August 1st and not later than September 30th, 1924. The charge is 8s. per month for each kVA of the maximum demand, plus a sliding scale, commencing at 0.7d. per kWh, decreasing for amounts over 100 kVA. The minimum payment is £4 per kVA per annum. The company's plan for a sub-station in Manchester Road has been approved, and the Council is preparing a scheme of electric street lighting.

Stafford.—ELECTRICITY EXTENSIONS.—The Town Council has approved of a scheme for the erection of a building capable of accommodating a new 3,000-kW set, and the provision of a 25-ton electric crane at an estimated cost of £17,413.

South Shields.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to borrow £59,650 to carry out extensions to the generating plant. Application will be made to the Unemployment Grants Committee for a grant. The electrical engineer anticipates a 20 per cent. increase in the demand for electricity during the next two years.

Sunderland.—ELECTRICITY SUPPLY.—The Town Council has authorised the Electricity Committee to proceed with the equipment of an underground sub-station at Mowbray Park and the laying of e.h.p. and l.p. mains in connection therewith, at a total estimated cost of £10,441, of which £750 will be borne out of revenue and the remainder out of capital. Application is also to be made to the Electricity Commissioners for sanction to the borrowing of £15,000 for mains.

STREET LIGHTING.—The Town Council has decided to convert 200 lighting standards in the borough from gas to electricity, the estimated cost being £1,000.

Worcester.—EXTENSION OF SUPPLY.—At a meeting of the City Council on April 15th, it was decided to seal the agreement with the Malvern Urban District Council for the supply of electricity to Malvern.

Tramway and Railway Notes.

Bolton.—NEW ROUTE.—The extension of the Brownlow Fold tramway to Lower Pools, Smithills, was recently formally inspected by the Ministry of Transport and the service commenced on the following day.

Bradford.—RAILLESS CARS.—The Finance and General Purposes Committee considered reports on April 11th on the proposals to apply for powers to convert the whole 24 tramway routes to the railless system, and rejected all proposals except that to run railless services between the city and Clayton, *via* the present tramway terminus at Lidget Green. The Clayton District Council has approved this scheme. All the local authorities affected by the remaining proposals had decided to oppose them.

Continental.—SPAIN.—A concession granted in favour of the Sociedad Anonima Tranvias Electricos de Granada for the construction of a secondary railway from Alhendin to Durcal, has received the confirmation of the Ministerio de Fomento.

The Sociedad Madrileña de Tranvias is applying for a concession to extend the electric tramway in Madrid.

Keighley.—TRAMWAY RECEIPTS.—During the year ended March 31st the Corporation tramway receipts were as follows:—Railed services, £20,444 (increase, £833), railless services, £5,777 (increase, £2,470).

London.—TRAMWAY SERVICE TO WEMBLEY.—In connection with the British Empire Exhibition, the Highways Committee of the L.C.C. has been in negotiation with the Metropolitan Electric Tramways, Ltd., on the subject of proposed through running arrangements *via* Scrubs Lane Junction to Sudbury or Wembley, and has recommended to the Council that an agreement be entered into with the company, to the following effect:—(1) The company forthwith to construct a junction between Scrubs Lane and Harrow Road on terms already agreed, *viz.*, the Council to pay 6 per cent. a year on one-half the cost of installing the junction, the Council's contribution to continue so long as the junction is used for a through service between the tramways of the Council and the company. (2) The Council exclusively to provide a through service of tramcars between Wembley and Putney or between such other points as may be agreed by the managers. (3) Each authority to determine the fares to be charged in its own area, through fares to be agreed by the managers. (4) The Council to retain the receipts from the service. (5) The Council to recoup itself in respect of operating expenses incurred in providing the service, plus capital charges for power in the Council's area. The Council to pay to the company the operating expenses incurred by the company in providing in the company's area power and traffic superintendence and maintaining track and electrical equipment. (6) The Council to pay to the company the amount of the receipts earned in the company's area. (7) On the company informing the Council that it can itself provide its proportion of the service, the agreement to determine. (8) The agreement to operate for three months from the date of commencing the service.

Plymouth.—TRAMWAY RETURNS.—A statement prepared by the manager of the Corporation Tramways shows that the total number of passengers carried during the year ending March 31st was 33,249,142, an increase of 2,587,019 as compared with the total for 1923, and the receipts amounted to £209,049, an increase of £9,463.

Telegraph and Telephone Notes.

Germany.—RADIO TELEGRAPHY.—The report and accounts for the year 1923, recently presented to the shareholders of the Transradio Aktiengesellschaft für Drahtlosen Uberee-Verkehr, show that the volume of telegraphic business from the Nauen and Eilvese stations was maintained during the year. Direct communication was opened with Egypt, and is being well supported, while extensions to the Nauen and Eilvese stations will be completed this year, and will enable

the company to communicate with any part of the world. On December 20th, 1923, the Eilvese station was being worked direct from Hamburg in order to cater efficiently for telegrams to and from that city and Bremen. A new receiving station has been erected on the Island of Sylt, and is working well. Direct communication has also been opened with the Buenos Aires station, jointly owned by the American, English, French, and German companies, and it is expected soon to open up direct communication with Rio de Janeiro and Pernambuco. Negotiations are in hand for sharing concessions in South and Central America. The erection of stations for the Dutch Government at Kootwijk (Holland) and Bandoeng (Java) was completed, thus facilitating direct radio communication between Europe and East India. Tests between the big station at Peking and Nauen were successful, and plans exist for the erection of other stations in East Asia. It is also stated that the Russian Government is planning the erection of a set of large stations between Moscow and Vladivostock, and reference is made to the contemplated Imperial chain and French plans for connecting up their Colonies. The figures in the accounts, in view of the depreciated exchange, are so enormous that difficulty is caused in assessing them at proper values. Thus the profit carried forward in respect of 1922 was 2,097,361 marks, which, when added to the profit in respect of 1923, produces a total profit of 129,685,831,377,040,503 marks. The total receipts for the year were 444,715,487,670,906,023 marks.

Italy.—Radio Telegraphy.—The Commercial Secretary at Rome (Mr. J. H. Henderson, O.B.E.) has forwarded to the Department of Overseas Trade a report on the position of radio telegraphy and telephony in Italy. Copies of the report may be obtained by United Kingdom firms interested upon application to the Department. (Reference No. 18,874/F.W./C.C./2.)

India.—Radio Relaying.—A test has shown that, under a new transmitting system, the Madras and Rangoon radio stations are workable from Bombay by a connected landline without rehandling. This has an important bearing on the Imperial link station in India. When direct working from London to Sydney is impossible, the operator in London will be able to transmit through India to Sydney without rehandling in India. The message will come to the Indian radio receiver and be automatically transferred by landline to the India-Australia transmitter and thence sent by radio to the Australian receiver, whence it will be automatically transferred to landline to be decoded at the Sydney telegraph office, a tape machine printing the message in full.—*Daily Mail.*

Radio Corporation of America.—Annual Report.—The annual report for 1923 of the Radio Corporation of America reveals its net income for 1923 as $4,737,774, as compared with $2,974,579 for 1922 and $426,799 for 1921. The Corporation's financial position has been further strengthened during 1923. Current assets have increased $3,531,791 and exceed current liabilities by $8,000,467. Two additional radio communication circuits were opened for commercial service during the year, connecting the United States with Italy and Poland, making in all nine channels of international message traffic. Nine radio circuits are now in operation to Great Britain, Norway, Germany, France, Italy, Poland, Japan, Hawaii, and Hawaii to Japan. Plans for high-powered trans-oceanic stations in Brazil have been approved. Service to the Argentine, on a deferred rate basis, through the medium of the high-power station at Buenos Aires, was inaugurated in February of the present year. The exchange of traffic with China is expected to prove profitable. Preliminary surveys for the erection of stations in China have already begun. In this enterprise the Federal Telegraph Co. of California invited the participation of the Radio Corporation, and the Federal Telegraph Co. of Delaware was formed. The operation of transatlantic circuits indicates that competition with the cables on even terms is being successfully met, and by a rearrangement of the central radio office in New York it is now possible to handle overseas message traffic by twelve distinct circuits.

The Radio Corporation operates five marine coastal stations which communicate with ships at sea. The traffic through coastal stations in 1923 was 36 per cent. greater than in 1922, and free medical service made available on ships at sea in co-operation with the U.S. Public Health Service and the Seamen's Church Institute of New York has rendered urgent emergency aid on many occasions during the year. Approximately 75 passenger vessels are now regular subscribers to the nightly Press service maintained through coastal stations. At the beginning of the year the Corporation furnished radio apparatus on a rental and service basis to 705 ships. By the close of the year these had increased to 759. Distribution of Radio Corporation products is accomplished through 116 distributors with 57 branches, making 173 wholesale outlet points. Gross sales of radio receiving apparatus amounted to $22,465,000.

The Telephone Service.—Cardiff Headquarters.—According to the daily Press, the Swansea Corporation is protesting against a Post Office proposal to amalgamate Swansea and Cardiff as a telephone district, with headquarters at Cardiff.

Cable Entanglement.—The coasting steamer *Mongeham* put into Ramsgate last week-end for repairs to her stern frame and rudder, which were caught by a steel-armoured telephone cable lying on the bed of the River Stour when she was passing Sandwich Bridge. Part of the river bank was torn away, but the cable is reported not to have been damaged.

Radio Notes.

Plymouth Relay Station.—More Power Needed.—The Cornwall Federation of Chambers of Commerce and Traders' Associations has decided to petition the British Broadcasting Co. to increase the power of the Plymouth relay station as soon as it is possible to do so, on the ground that the station at present is serving only a small area and that a large number of owners of small receivers in Cornwall find themselves entirely left out.

Spain.—Radio Telegraphy Regulations.—Regulations in connection with radio telegraphy are to be introduced in Spain. The legislation seems likely to be tolerant, but Spanish manufacturers engaged in the construction of apparatus will be favoured.—*Reuter's Trade Service* (Madrid).

Transatlantic Working.—Hand Generator Feat.—"Reported by U3Ds, Philadelphia, radiation 0.5 pure c.w. received on March 3rd." This laconic message has reached Mr. W. E. F. Corsham (2 UV), who has undoubtedly achieved a record in transatlantic working. He had been handicapped in his work by the lack of a power supply other than dry batteries, but he borrowed an Evershed & Vignoles hand-operated generator and by its aid bridged the Atlantic. This small machine, which was illustrated in our columns some time ago, has an overall length of only 11½ in., including approximately 4 in. for the driving handle, so that the transmission reported may be regarded as a remarkable feat.

United States.—Railway Broadcasting.—The possibility of operating a broadcasting station at Philadelphia by the Pennsylvania Railroad for communicating with other divisions in emergency, which was discussed by railroad officials as a result of recent storms, has been abandoned, at least for the time. It was found that the Federal Radio Bill passed in 1912 prohibited the operation of a commercial broadcasting station of a stronger power than 500 watts within five miles of a Government station. In the meantime the railroad has made arrangements with amateur members of the American Radio Relay League to send railroad messages in emergency.—*T. and T. Age.*

Short Wave Broadcasting.—The difficulties which have attended past American efforts to hear wireless concerts from England may be eliminated by a plan outlined by Mr. S. P. Davis, vice-president of the Westinghouse Electric Co., which operates the broadcasting station KDKA at Pittsburgh. Mr. Davis, according to the daily Press, has revealed that experiments have been successfully made in using inaudible high-frequency waves through repeating stations without interference. By using inaudible waves of a length of 100 metres or less the transmission does not interfere with local broadcasting on so-called audible waves of between 250 and 600 metres. The inaudible waves can be amplified and re-broadcast locally on audible waves. Mr. Davis said that only details of organisation remained to be perfected before listeners could hear speeches and musical programmes from any part of the world.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argentina.—Buenos Aires.—May 28th. Department of Sanitary Works. Electrical power plant for the pumping station at Pergamino.*

Barnes.—May 12th. Electricity Department. Two 500-kW rotary or motor converters, with h.p. and l.p. switchgear. (April 11th.)

Belfast.—May 5th. Electricity Department. D.C. switchgear for sub-stations. (April 18th.)

Belgium.—April 29th. Service d'Electricité, of Liége. 1,200 joint boxes and 1,000 house connection boxes. Specifications (5 fr.) from Services Industriels, Annexe de l'Hotel de Ville (1-er. Etage), Liége.

April 30th. Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels. Supply of 20,000 kilometres of 50 sq. mm. section bare cable. Particulars, Cahier des Charges Special No. 4-12.

April 30th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 22 lots of material required for the maintenance of the State telephone and telegraph lines. Particulars (Cahier des Charges Special No. 3-4) for 2 fr. 20 c.

May 14th. Installation of selectors on the lines of the Brussels interurban telephone office and the central telephone exchange at Linthout. Particulars (Cahier des Charges Special No. 3-12) for 1 fr. 90 c.

May 3rd. Municipal authorities of Ghent. Two transformer cabins and the extension of the sub-station in the Rue Farman. Particulars, Cahier des Charges No. 1,559.

May 8th. Municipal authorities of Schaerbeek, Brussels. Establishment of a static transformer cabin. Particulars (5 fr.) from Service de l'Electricité, Hotel Communal, Schaerbeek.

(Continued on page 663.)

The Calcutta Electricity Supply Undertaking.

The Cossipore Power Station.

By W. TWINCH, A.M.I.Mech.E., A.M.I.E.E., M.I.E.(Ind.).

THE work of building the Cossipore electricity generating station commenced at the end of 1910, and it first supplied energy on July 20th, 1912. The station was designed by Messrs. Kennedy & Donkin (consulting engineers) to supersede four existing stations of the Calcutta Electric Supply Corporation, Ltd., its original equipment consisting of four 3,000-kW Oerlikon turbo-alternators. From time to time, the capacity of the plant was increased until in 1921 five 3,000-kW Oerlikon sets and one 6,000-kW British Thomson-Houston set were installed. The original boilers were of the Babcock & Wilcox and the Stirling types.

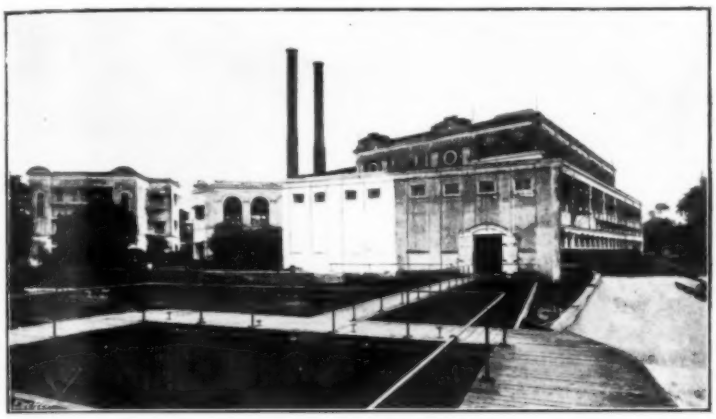


Fig. 1.—The Cossipore Power Station, Calcutta.

In 1920, in order to meet the prospective demand, one further 6,000-kW and one 15,000-kW B.T.-H. sets were ordered together with new boilers, coal-handling plant, switchgear, and a new circulating-water system. This increase in plant necessitated adding to the turbine house to accommodate the new machines, new bays to the switchgear annexe to house the extension switchgear, and a new boiler house. Before this extension came into commercial use it was realised that the growth of the undertaking would soon once more outstrip its plant capacity, and an additional 15,000-kW set built by the English Electric Co., Ltd., together with additional Stirling boilers, was ordered.

At the moment, therefore, the installed capacity of the station is as follows: One 500-kW Belliss-Crompton d.c. set, one 15,000-kW English Electric set, one 15,000-kW and two 6,000-kW B.T.-H. machines, and five 3,000-kW Oerlikon sets; a total of ten sets having a combined output of 57,500 kW. The pressure of generation is 6,000 volts, at which voltage the energy is distributed to 10 sub-stations placed at suitable points throughout the central area of the City at a distance of about one mile from each other. In them three-phase current at 6,600 volts received from Cossipore is transformed to direct current by motor converters of Bruce Peebles make, and is distributed throughout this portion of the City on the 3-wire system at 440 volts across the outers.

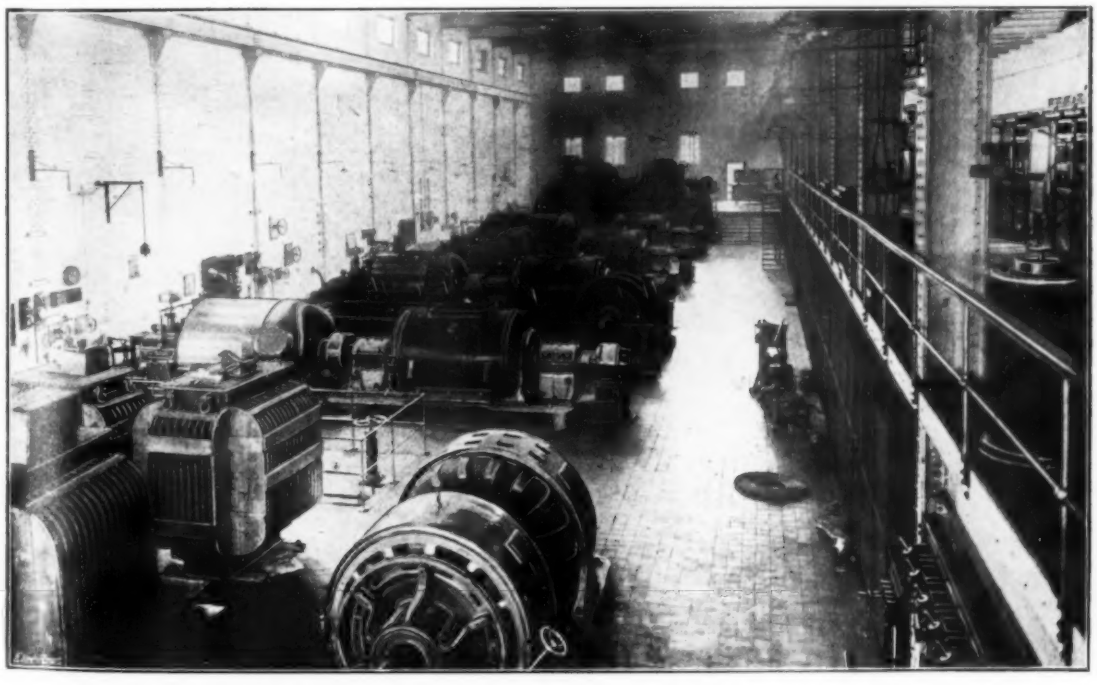


Fig. 2. Turbo-generator Room from Switchboard; B.T.-H. Set at Far End.

F

The southern area of Calcutta, comprising four sub-stations and the docks, is fed through British Electric

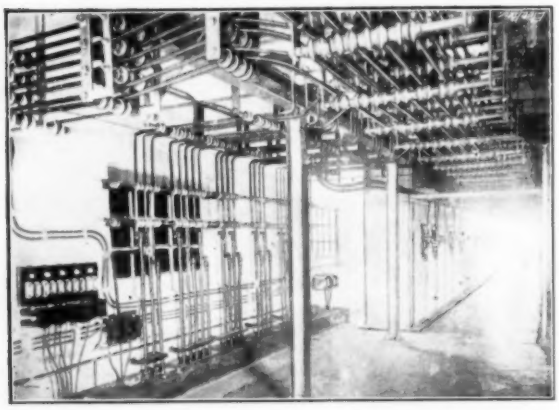


Fig. 3.—B.T.-H. Cells and D.C. Rod Work under Switchboard; Prinsep Sub-station.

step-up, 6,000/30,000-volt, transformers, the pressure being reduced again at the respective sub-stations to 6,000 volts; this transmission is made by two 3-core, 0.15 sq. in., 30,000-volt cables by Messrs. W. T. Glover & Co., Ltd. In the area lying outside the centre of the City, further sub-stations are provided in which three-phase current at 6,000 volts (received from Cossipore either through the 30,000-volt mains and transformed, or direct at 6,000 volts) is transformed by means of static transformers to a 400-volt, 4-wire, a.c. system giving 230 volts between any phase and the neutral. There is also a very considerable three-phase, 6,000-volt, distribution system for the supply to mills and factories, as well as a subsidiary three-phase power supply at 400 volts for the stated sub-stations.

The new buildings are constructed on a reinforced concrete raft designed to take the building stanchions, which is made sufficiently strong to prevent any portion of the foundation sinking unless the raft sinks as a whole. The boiler-house building is kept distinct from the actual boiler structures, so that no heat stresses are transmitted to the building. In a similar manner the turbine-house floor is separately supported from the raft to prevent turbine vibration being transmitted to the walls of the building.

The turbines installed since 1920 are designed for a steam pressure of 175 lb. at a total temperature of 700 deg. F., and a vacuum of 28 in. Their rated load is the most economical point on the steam consumption curve, but their maximum continuous rating is considerably higher, *i.e.*, 7,500 kW for the 6,000-kW, and 18,750 kW for the 15,000-kW sets. Each governor is oil controlled, and is fitted with hand- and motor-operated speed-adjusting gear. The controls for the governor motor are led back to the switchboard, and the speed can be varied at will by the switchboard attendant for interchange of load purposes, and for synchronising. Engine-room telegraphs are fitted near the turbine stop valves and on the control gallery to

Fig. 4.—Switchboard at Cossipore Power Station.

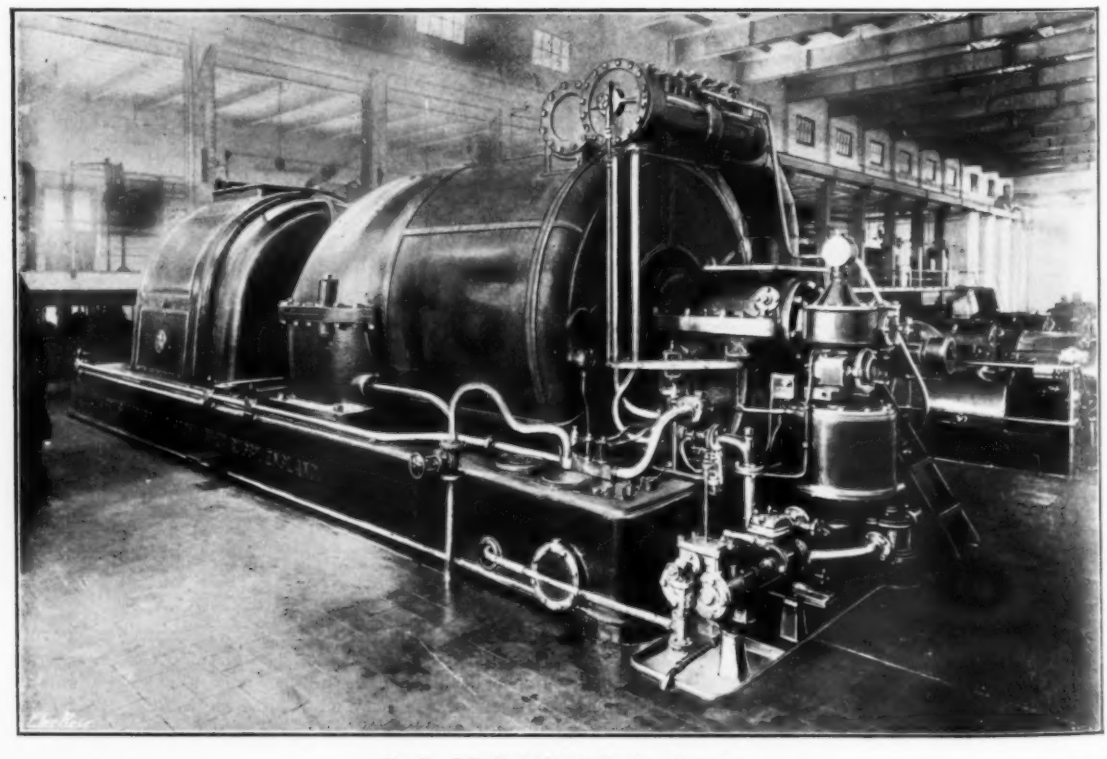


Fig. 5.—B.T.-H. 6,000-kW Turbo-Alternator.

warn the driver when any alteration is required. The turbines are fitted with "pass out" pipes to abstract steam from the turbine after it has done some work and pass it through a feed-water heater for raising the temperature of the condensate on its way to the degassing plant.

The earlier sets in the station are equipped with Allen condensing plant and Edwards air pumps. The later installation is Hick, Hargreaves condensing plant with steam "Ejectairs" and motor-driven condensate pumps, and the heat from the steam used in the "Ejectair" jets is recovered in the condensate in a feed-water heater on its way back to the boiler feed pumps.

Fig. 6.—Elgin Road Sub-station.

through a feed-water heater to the degassing plant, made by the Contraflo Condenser & Kinetic Air Pump Co., in which it passes over a reagent that removes any traces of oxygen and is then returned to the boiler feed pumps, air free and perfectly pure.

The new boiler plant consists of six Stirling boilers, each capable of evaporating 60,000 lb. of water per hour under normal conditions, and 75,000 lb. per hour for a period of two hours. Three boilers are equipped with Erith-Riley stokers with forced and induced draught, and three boilers are equipped with "A" type Underfeed stokers also with forced and induced draught. The boilers are controlled by a set of instruments mounted on the front of each boiler, and consisting of pressure gauge, steam-flow meter, CO_2 indicator, balanced-draught gauges, two flue gas temperature indicators, feed-water flow meter, and forced-draught air velocity gauges. The controls for both forced- and induced-draught fan motors are brought on to the firing floor in close proximity to the damper and stoker-motor controls so that the supervisor has everything to his hand. In addition, electrical recorders are installed in a boiler-house control cabin, and the senior operator on duty can see at a glance the performance of any boiler on the range at any moment, and the station superintendent has a permanent daily record of performances.

The boilers and economisers are all arranged with large hoppers for ash and soot, and are all fitted with "Diamond" soot blowers for removing the soot from working boilers without opening any sight holes, or doors, or disturbing normal combustion. The soot is collected in hoppers and is drawn therefrom into a central collecting receptacle by means of an exhauster plant. The ash is withdrawn from the hoppers beneath

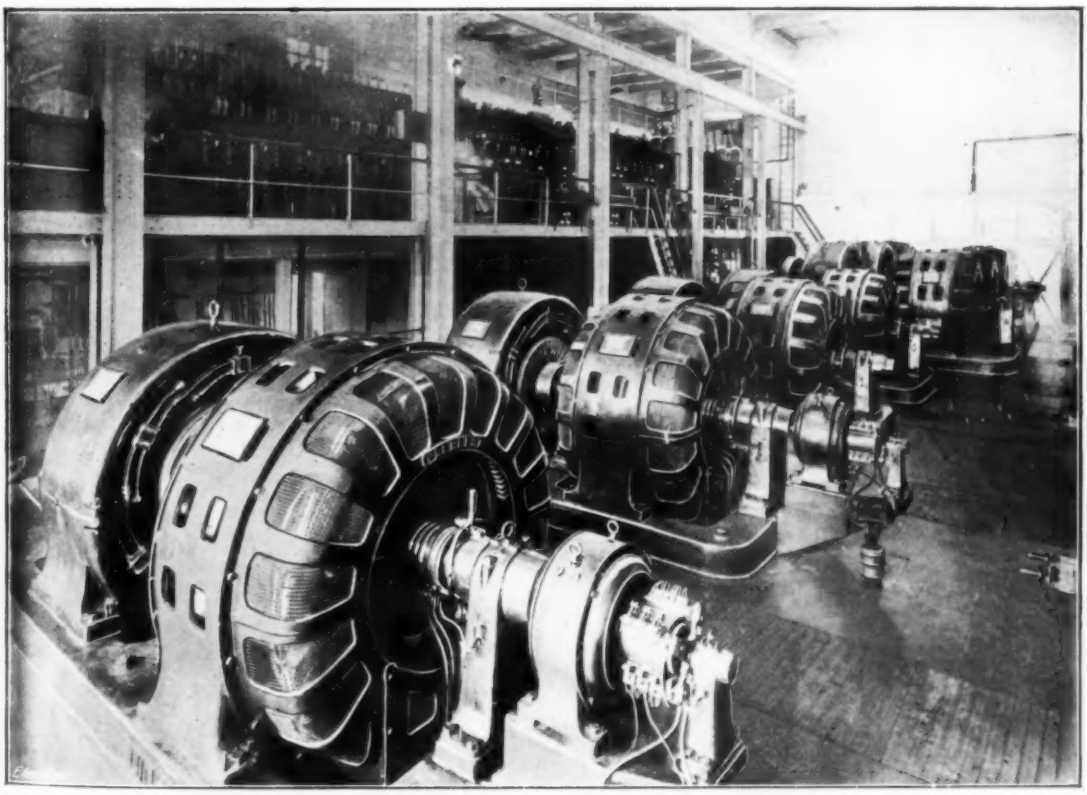


Fig. 7.—Prinsep Street Sub-station; B.T.-H. Switchboard and Bruce Peebles Converters.

For the large units both "Ejectairs" and condensate pumps are provided in duplicate, and either can deal with the full load of the turbine. The whole system is arranged for "closed feed," *i.e.*, the condensate is kept out of contact with the air throughout the system. The condensate passes from the extraction pump

the boilers every six hours or so into trucks for disposal.

The boiler feed make-up is obtained from a P. & B. evaporator of a capacity of 10 tons per hour when working in double effect. The plant is in duplicate, and is arranged so that either section can be worked in single effect or the whole plant as one unit. The raw feed water is drawn from the River Hooghly, and the three motor-driven feed pumps are by Messrs. Mather and Platt, any two being sufficient for the full requirements of the extension, and part of the old boiler houses. Feed mains are coupled through to the old station so that in case of emergency the new station can feed the old, or *vice versa*. The feed pumps in the old station are steam-driven and, therefore, act as a stand-by to the electric pumps in case of a total cessation of supply.

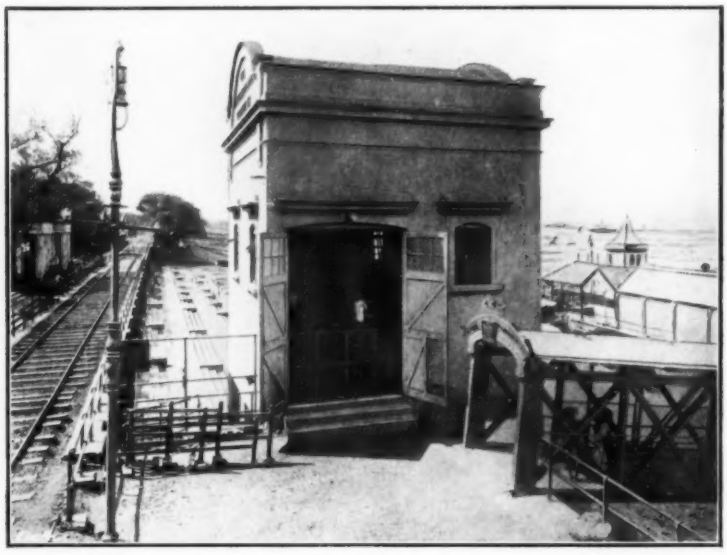


Fig. 8. River Bank Sub-station.

The switch control gallery is arranged in sections for the control of the 6,000-volt circuits, the 400-volt a.c. auxiliary circuits, and the d.c. auxiliary circuits. There are also a few local outgoing d.c. feeders.

Fig. 9.—Coal Truck Tippler.

The 6,000-volt switchgear is of the cellular B.T.-H. type with each phase for each feeder, or machine, in a separate line of compartments. The oil switches are motor operated from the control gallery. The bus-bars are split up into three groups with reactances between groups, and any machine and any feeder normally works on its own group, or in case of emergency, on a second group. The turbine control panels are fitted with a field resistance, ammeter, Tirrill pressure regulator, governor control switch, turbine signalling device, and temperature indicators for the alternators.

The supply for the auxiliary circuits is taken direct from the 6,000-volt bars to three 700-kVA single-phase Metropolitan-Vickers transformers. The l.p. side of the transformers supplies the a.c. board, and all the outgoing feeder circuits to the distribution boxes. The l.p. a.c. auxiliaries include the condensate pump motors, air filter motors, circulating water pump motors, forced draught fans, induced draught fans, coal crushers, crane, electric capstans, and stoker motors.

In addition to the transformers there is a 1,000-kW G.E.C. motor-generator installed as a "missing link" between the a.c. and d.c. sides, *i.e.*, the machine can either take l.p. a.c. from the transformers and supply d.c., or in the event of a double breakdown of the transformers it can take d.c. from the bars and supply l.p. a.c. for the station. The direct-current supply at Cossipore is used for various auxiliary motors, especially in the older part of the station. It can be fed initially and on emergency from the Belliss-Crompton set already mentioned, but it is normally fed through two motor converters of Bruce Peebles make. There is, however, also installed a 930-ampere-hour (10-hours rating) 440-volt battery, which is kept floating on the d.c. bus-bars by means of a reversible booster. This battery enables continuity of supply to be obtained through the motor generator already mentioned to the essential a.c. auxiliary plant motors in the event of a total shut down, and until the Belliss d.c. set is got under way. The alternators are protected by Merz-Price gear and field-suppression switches. The balance protective gear works in conjunction with a trip switch on the air supply

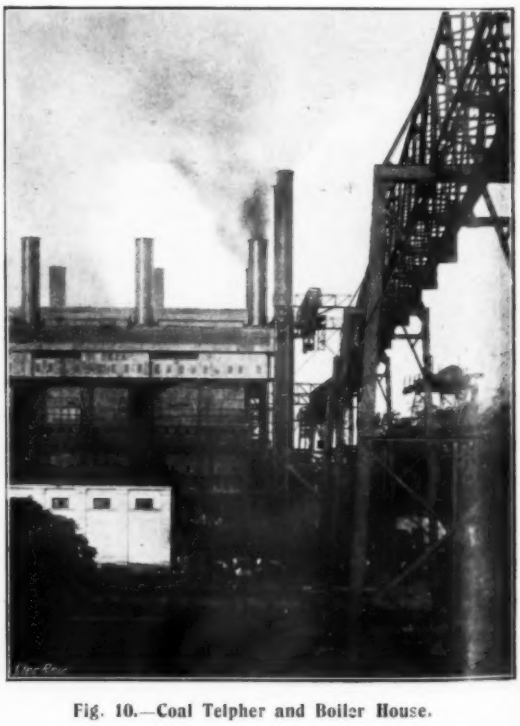


Fig. 10.—Coal Telpher and Boiler House.

damper, which is over-balanced and is normally held open by a catch; in the event of an internal "short" the balance protective gear will trip the main oil switch, thus clearing the machine from the bus-bars, and at the same time trip the damper and shut off the air supply to the machine.

The station as originally designed had a condenser circulating water system on the "intake" and "outfall" channel principle. A pump house with vertical d.c. pumps was erected on the foreshore, and each pump equipped with its own suction pipe brought out into a screened enclosure in the river; the ends of the suction pipes are hinged and the final 30 ft. of pipe rises and falls with the tide.

The condenser cooling water system for the new portion of the station is on a siphon system, *i.e.*, a new pump house has been constructed in the river, and five vertical pumps by Messrs. W. H. Allen, Sons and Co., Ltd., are installed in caissons. The pumps raise the water and force it through a 51-in. main through any of the new condensers in use and back to a sealed outfall through a 45-in. main. The outfall is sealed in a pond behind a fixed weir at a level slightly above that of the lowest tide, in order to avoid the excessive expense of running the discharge pipe a great distance out into the river for such low tides as occur only at certain periods of the year. Vacuum pumps are fitted to a catchpot on the turbine-house roof, and the highest points on the pipework are connected to the catchpot in order to keep the siphon system air-free.

The coal-handling plant is designed to deliver rail-borne coal to the overhead bunkers in the new boiler house or the ground hoppers for the uptake conveyors for the old boiler house and, in case of necessity, to convey coal to or take coal from the stock heaps in the yard.

The arangement is as follows:—Loaded trucks are brought in on the southern siding, and shunted by petrol locomotive to within reaching distance of the first capstan. The loaded truck is then drawn on to the weigh-bridge, and thence into the truck tippler which lifts it bodily and tips its contents into the overhead bunker. The coal feeds from the overhead bunker through either of two 100-ton per hour crushers on to an endless belt that discharges it to the grabbing hopper. For closed trucks the tippler has been designed to hold the truck, and the remaining one-third is got out by hand; open trucks are completely emptied in one operation. This portion of the plant was made by the Mitchell Conveyor & Transporter Co., Ltd.

Three telpher carriages go with the telpher track. The first grabs coal with an automatic grab from the grabbing bunker and delivers it to either line of bunkers in the new boiler house. The second grabs coal from the grabbing bunker and discharges it to either of the old boiler-house uptakes, or to the stock heap; and the third is arranged with a yoke for taking up two ash skips at a time and automatically dumping their contents into the ash hopper at the end of the telpher run near the main station gate. This portion of the plant was made by Messrs. Strachan & Henshaw, Ltd.

Rails for the ash bogies are laid in the boiler-house basement and trucks of unquenched ash are led out in pairs underneath the low-level telpher ready for the lifting yoke.

The centre portion of the boiler-house basement underneath the firing floor has been walled off so as to prevent the ingress of ash dust and ensure a clean fresh-air supply for the forced-draught fans for the boilers. The south end of the basement is left open through to the turbine house, and the filtered air from the turbo-alternators is forced into the suction space mentioned above, thus utilising the hot air for the boiler supply.

The Inventions Commission.—The Royal Commission on Awards to Inventors on April 14th heard *in camera* Dr. T. F. Wall's claim in respect of apparatus for the control of vessels by means of radio signals.

Contracts Open and Closed.

(*Continued from page 658.*)

Bri Chualann.—May 6th. Urban District Council. Electrical stores. (April 18th.)

Chile.—Santiago.—May 26th. Chilean State Railways. Telephones, switchboards, copper and g.i. wire and cables, dry cells, insulators, &c.*

Colchester.—June 2nd. Electricity Department. 20-ton travelling crane, dry-back boilers, water-tube boilers, coal-conveying and handling plant, steel chimney, induced draught fans, turbo-alternators, condensing plant, pumps, rotary converters, transformers, e.h.p. and l.p., a.c., and d.c. switchgear, cable connections, valves, pipes, &c., feeder and pilot cables, transformers, and equipment for sub-stations. (See this issue.)

Edinburgh.—May 12th. Electricity Supply Department. Extensions to d.c. switchboard. (April 18th.)

Glasgow.—April 26th. Electricity Department. Cables, meters, and carbons for 12 months. (April 11th.)

April 29th. Lighting Department. Supply of materials for one year from June 1st next, including brass mountings, electrical fittings and accessories, lamp pillars, tin plate, copper, &c. Specifications from office of the Department, 20, Trongate.

Grimsby.—May 2nd. Electricity Department. 3,000 yd. 6,600-V feeder cable and pilot cable, and 3,000 yd. distributor cable. (April 18th.)

Hornsey.—April 26th. Electricity Works. L.p. generator and feeder switchboards. (April 11th.)

Hyde.—May 3rd. Town Council. Installation of fire alarms and police telephones. Borough surveyor, Town Hall.

London.—Southwark.—May 1st. Board of Guardians. Installation of a complete electric lighting scheme at the Southwark Hospital, East Dulwich Grove, S.E. (April 11th.)

St. Marylebone.—April 30th. Electricity Supply Committee. L.p. and e.h.p. cables for 12 months. (April 11th.)

London County Council.—May 5th. H.p. switchgear, control panels, &c. (April 11th.)

May 19th. Motor-driven belt-conveyor coal-handling plant for Greenwich power station. (April 18th.)

Maesteg.—May 27th. Urban District Council. L.p. overhead and underground distributing mains, switchgear, and suspension lighting of highways. (See this issue.)

Manchester.—May 2nd. Electricity Committee. 6,600-V, 3-phase switchgear for sub-stations. (April 11th.)

Newport (Mon.).—May 1st. Electricity Department. 750-kW and 300-kW rotary converters, 500-kW house turbo-alternator, and ash-handling plant. (April 11th.)

New Zealand.—Wellington.—June 17th. Public Works Department. Oil switches, relays, and current transformers for the Lake Coleridge scheme.*

June 24th. Twelve electric ranges for the Mangahao power scheme.*

Penang.—George Town.—May 20th. Municipal Commissioners. One 3,000-kW turbo-generator and condensing plant. (See this issue.)

South Africa.—Johannesburg.—May 9th. Rand Water Board. Five coal elevators and 10 coal chutes at Zwartkopjes.*

May 30th. Municipal Council. Motor converter and three rotary converters.*

Southampton. — April 30th. Electricity Department. E.h.p. 3-phase cables, e.h.p. switchgear, and 3-phase transformers. (April 11th.)

Stockton-on-Tees.—May 5th. Electricity Department. Two 300-kVA, 3-phase transformers. (April 18th.)

Stoke-on-Trent. — May 14th. Electricity Department. Circulating water pipes and valves, steam pipes and valves. (April 18th.)

Uruguay.—Montevideo.—June 17th. Port authorities. Electric winch and capstans.*

Warrington. — April 29th. Electricity Department. Steam pipes and water pipes. (April 11th.)

---

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aylesbury.—Town Council. Accepted:—
Gas-producer plant at the electricity works (£294).—Crossley Bros., Ltd.

Belgium.—Three home concerns competed last week for the supply of phosphor bronze wire to the Belgian State Railway authorities in Brussels. The lowest offer (390,764 fr.) was that of E. Geisler-Lignian, of Schaerbeek.

Blackpool.—Accepted:—
Electrical installation at the North Pier Pavilion.—J. Lomax Kendall & Co.

Bolton.—Tramways Committee. Accepted:—
800 tons Sandberg steel tram rails.—Bolckow, Vaughan & Co., Ltd.
Steelwork for Bridgman Street car shed extension.—John Booth & Sons, Ltd.

Dumfries.—Parish Council. Accepted:—
Installing electric lighting at Rosevale House (£245).—South of Scotland Engineering Co.

Eastbourne.—Electricity Committee. Recommended:—
Cooling tower (£2,519).—Premier Cooler & Engineering Co. Seven tenders were received, varying from £2,325 to £5,575.

Faversham.—Town Council. Accepted:—
Cable for renewals (£353).—W. T. Henley's Telegraph Works Co., Ltd.

Glasgow.—Health Committee. Recommended:—
In connection with the artificial sunlight treatment of tuberculosis.
Motor generating set (£211).—H. Green & Co.

Tramway Committee. Recommended:—
Poles.—Stewarts & Lloyds, Ltd.
Seamless brass tubing.—Earle, Bourne & Co., Ltd.
Automatic sanding apparatus.—John Eades.
Rotaries and switchgear for Paisley sub-station.—English Electric Co., Ltd.
Motor generator set.—British Electric Plant Co.
Coatbridge and Airdrie tramways and street works.—Shanks & McEwan.

Kendal.—Accepted:—
Electric lighting installation at the parish church.—T. S. Bell & Co.

Kingstown (Co. Dublin).—Urban Council. Accepted:—
Alterations in connection with the electric lighting scheme.—Mirrlees, Bickerton & Day; Bruce Peebles & Co., Ltd.

Lyme Regis.—Town Council. Accepted:—
Reorganising the plant, &c., at the electricity works (£6,568).—G. E. Taylor & Co.

Manchester.—Tramways Committee. Accepted:—
Copper trolley wire.—British Insulated & Helsby Cables, Ltd.
Bronze trolley wire and cadmium copper trolley wire.—T. Bolton and Sons, Ltd.

Electricity Committee. Accepted:—
Cable.—Western Electric Co., Ltd.; Pirelli-General Cable Works, Ltd.; Macintosh Cable Co., Ltd.

Peterborough.—Town Council. Accepted:—
Erection of overhead mains to King's Dyke (£2,641).—Callender's Cable and Construction Co., Ltd.

Preston.—Tramways Committee. Accepted:—
For the Sandberg *in situ* treatment of two miles of single tram track, £1,584 per mile.—Scholey Construction Co., Ltd.

Royton.
Electrification of Gravel Hole Mill.—H. Lowe & Sons, Ltd. (Accepted.)

Swindon.—Town Council. Accepted:—
Circulating-water screen and accessories for the electricity works (£610).—F. W. Brackett & Co., Ltd.
Increasing the capacity of the existing battery (£1,200).—Tudor Accumulator Co., Ltd.

Forthcoming Events.

British Empire Exhibition (Wembley Park).—April to October.

British Industries Fair (White City).—April 28th to May 9th.

Institution of Electrical Engineers (Mersey and North Wales (Liverpool) Centre).—Monday, April 28th. At the University, Liverpool. At 7 p.m. Paper on "Power Circuit Interference with Telegraphs and Telephones," by Mr. S. C. Bartholomew. Annual general meeting.

(East-Midland Sub-Centre).—Tuesday, April 29th. At Loughborough College. At 6.45 p.m. Paper on "Special Dynamo Electric Machines for Wireless and Allied Applications," by Mr. F. Newton.

(North-Midland Students' Section).—Tuesday, April 29th. At the University, Leeds. At 7 p.m. Annual general meeting.

Illuminating Engineering Society.—Monday, April 28th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Some Problems in the Lighting of Textile Mills," to be opened by Mr. E. L. Oughton and Mr. F. J. Waldram.

Institute of Marine Engineers.—Tuesday, April 29th. At the Institute, The Minories, E. At 6.30 p.m. Paper on "Motor Drive for Auxiliaries on Board Ship," by Mr. L. Miller.

Institution of Civil Engineers.—Tuesday, April 29th. At the Institution, Great George Street, S.W. At 6 p.m. Further discussion on papers on the Barton power station and the Dalmarnock electricity works.

Radio Society of Great Britain.—Wednesday, April 30th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Lecture on "Faithful Reproduction by Broadcast," by Capt. P. P. Eckersley.

Informal Meeting.—Friday, May 2nd. At the Institution of Electrical Engineers, Savoy Place, W.C. At 6.30 p.m. Discussion to be opened by Capt. P. P. Eckersley.

Liverpool Engineering Society.—Wednesday, April 30th. At 9, The Temple, Dale Street. At 8 p.m. Annual general meeting.

Faraday House Old Students' Association.—Friday, May 2nd. At the Hotel Cecil. At 8 p.m. Annual smoking concert.

Junior Institution of Engineers.—Friday, May 2nd. At 39, Victoria Street, S.W. At 7.30 p.m. Lecture, "Electric Lighting in Churches," by Mr. F. H. Taylor.

London Association of Foremen Engineers.—Saturday, May 3rd. At the Cannon Street Hotel. At 6.30 p.m. 71st anniversary festival.

Notes.

The National Association of Supervising Electricians.—Prizes are again offered for papers by members dealing with the electrical industry or the Association. The principal prize is the shield presented by the president (Mr. W. E. Highfield), and three other awards will be made. Papers must be sent to the general secretary by May 6th; they should be about 1,000 words in length; and the prizes will be awarded on May 13th at a special meeting, at which members will decide by vote the prize-winning papers.

Architectural Lighting.—A publication of great value to architects in drawing up plans for ornamental exterior lighting is being distributed by the Westinghouse Electric & Manufacturing Co. The publication, which is known as No. C.1674, is entitled: "Ornamental Brackets, Newels and Lanterns." As it has been issued primarily for use in architects' offices, the filing classification of the American Institute of Architects has been inscribed on the cover of the book to facilitate its use as an office reference. A great number and variety of exterior lighting units, artistically designed for use in the illumination of entrances and facades of public buildings, the gateways of residences and private grounds, and the passageways of bridges and viaducts, are included in this comprehensive publication. With the requirements of the architect particularly in mind, an excess of descriptive matter has been dispensed with, yet each unit is so adequately presented that its adaptability for a particular installation can be readily determined. For every type of fixture included in the booklet, a clear photograph and a dimensional drawing are provided, together with a very brief description. Views of actual installations of many of the units are also contained.

Accident.—While Mr. R. McMurray, manager of Ballybay (Co. Monaghan) Electric Light Co., was starting an engine at the works his clothing caught in the flywheel and he was rendered unconscious and badly injured about the body. He has since been under medical treatment, and is making good progress.

Appointments Vacant.—Engineer for the preparation of a scheme for a power station, &c., for the Borough of Port Talbot; power station superintendent for Stoke-on-Trent Corporation Electrical Engineers' Department. (See our "Official Notices.")

An Electrical Telemeter.—Development work has been in progress for several years at the United States Bureau of Standards on an electrical telemetric device suitable for the measurement of strains, forces, displacements, and accelerations, with the view of making an instrument for remote reading and recording, adapted to the measurement of quantities that are rapidly varying in value. Satisfactory progress has been made and sufficient accuracy and stability have been obtained for many kinds of engineering measurements. For its operation this device depends upon the displacement-resistance characteristic or corresponding pressure-resistance characteristic of a stack of carbon plates. Means for mounting such stacks have been devised that permit accurate and dependable calibration and give sufficient stability to readily withstand the shocks due to ordinary handling. Practical applications so far made consist of the following: Measurement of loads in airplane stay cables during flight; measurement of strains in airship girders during construction; tests of bridge members subjected to live loading; tests of airship girders and bridge members in the laboratory; measurement of pull or pressure arm of dynamometer; and measurement of pressure. The chief advantages obtained over instruments previously available for similar purposes are that simultaneous records or readings can be made of strains, forces, and pressures occurring at a number of widely-separated points, and that rapidly-varying values can be photographically recorded in their true proportions. Measurements can also be made in places which are inaccessible during tests. The instrument is fully described in Technologic Paper No. 247 of the Bureau of Standards.

Local Societies.—Chelmsford Engineering Society.—The Society held its annual conversazione on April 12th, and a very successful evening resulted. An excellent musical programme was arranged, and there were many interesting and instructive scientific demonstrations and exhibits, including stroboscopic experiments, electrical toys, broadcasting receivers, Geissler tubes, an "otophone," aircraft radio apparatus, various chemical experiments, and an X-ray demonstration. In the absence of the president, Mr. A. A. Campbell Swinton, through illness, Mr. J. H. Johnson presided. The secretary's report on the year's work showed a good increase in membership, and a satisfactory financial result.

Water Power in Ireland.—Lecturing at the Royal Irish Academy, Dublin, on the natural sources of power and industrial development in Ireland, Mr. George Fletcher, F.G.T., recalled that it had been often stated that it was useless to provide water power in that country when there were no industries by which it could be utilised. He pointed to Switzerland in order to show how power was first provided, and the industries came rushing up after it. In Ireland power could be applied, for instance, in the leather and textile industries, while with very little expenditure in Co. Donegal power could be obtained for the manufacture of calcium carbide, a lot of which was imported.

At the last meeting of the Croydon Wireless and Physical Society, Mr. G. Hale, one of the members, lectured on "Short Wave Reception," illustrating by diagrams simple methods which he had found satisfactory. The next meeting will be held on April 28th, when Mr. L. F. Fogarty will lecture on "Distortion in the Reception and Transmission of Speech and Music."

Electric Field in Electrolytic Cell.—Mr. A. A. Ahmed, Ph.D., M.Sc. (Eng), A.M.I.E.E., has contributed to the April I.E.E. *Journal* the results of a theoretical and experimental study of the electric field produced when a current flows in an electrolytic cell having plane parallel electrodes. On the theoretical side a general expression for the electrolytic conductance is derived in terms of the stream flux and the potential difference between the electrodes, and is applied to special problems of complex transformations. The distribution of the electric stress along the surface of parallel plane electrodes is also determined mathematically. The experimental work has been planned with two objects in view: (1) To verify the theoretical results by means of experiments in which the mathematical conditions are represented with sufficient and reasonable accuracy; and (2) to apply the theoretical results for the solution of certain practical questions, and to investigate experimentally how far such applications agree with test results. Both objects have been in some measure satisfactorily attained. On the side of electro-physics the validity of Ohm's law is proved for any elemental current in the electrolyte by a direct experiment devised for this purpose. The significance of this result lies first in its providing tangible evidence of the coincidence of stream lines with lines of force everywhere in the electrolytic medium, and, secondly, in its proving that under certain conditions an electrolyte may be taken to represent a perfect homogeneous dielectric with something approaching mathematical precision. As an example of the practical application of this theorem, a method is derived for calculating the conductance of such apparatus as metal-refining and simple electro-deposition tanks, and certain types of liquid rheostats. A practical chart which is provided for this purpose may prove useful to the designers of such apparatus. Furthermore, the results obtained may find a field of application in the measurement of electrical and magnetic phenomena where the distribution of energy is analogous to that shown to exist in the electrolytic cell, as, for example, the capacity of an irregular system of conductors or the reluctance of a magnetic circuit.

An Illuminated Tramcar.—Following upon the recent electrical exhibition arranged by the Preston Corporation as a preliminary to the opening of the new power station, an illuminated tramcar was designed. This car, which is shown in the accompanying illustration, was decorated in an amber and black scheme—this being the distinguishing

An Illuminated Preston Tramcar.

feature of the whole exhibition—and there was no suggestion of advertising. The various circuits were controlled by a motor-driven "crawling flasher" carried inside the car, so that a variety of "effects" were constantly produced. "Siemens" metal and carbon-filament lamps were employed throughout, there being about 300 white and 500 amber-coloured lamps.

Fatality.—Mr. Charles Barlow, chief electrician at the Cargo Fleet Ironworks, Middlesbrough, died in the North Ormesby Hospital on April 19th, as the outcome of an accident. On Good Friday afternoon he was working in the rolling mill when his coat was drawn into the rolls.

Report on City & South London Railway Subsidence.—A report on the subsidence which occurred on the City & South London Railway on November 27th last has been made to the Ministry of Transport by Lt.-Col. A. H. L. Mottut.

The Inspector states that the failure, which caused an interruption to electricity, gas, and water services, was apparently due to the combined effects of insufficient cover of homogeneous clay under the water-bearing gravel; the consequent presence of water; and the vibration caused by passing trains. The actual collapse in the centre of the tunnel roof was possibly the result of inadequate thickness and insufficient bearing of the poling boards to withstand the excessive pressure.

The Inspector approves the railway company's decision to close the route until the completion of the work.

Standard Tests for Hydraulic Power Plant.—The report of the Joint Committee of the Institutions of Civil and Mechanical Engineers on this subject was recently presented at a meeting of the latter body. It comprises some 18 pages, with an appendix of 12 pages. The measurements concerned relate to the volume of water flowing, the total energy of the water at entrance and exit, and the work done by the turbine. Definitions occupy four pages, after which the appropriate subdivisions of the plant and the measurements necessary are detailed, and a long section is devoted to the method of making measurements. The remaining sections relate to operating conditions, the duration of tests, and the mode of tabulating the results, the necessary tables occupying six pages.

In the appendix the use of the Venturi meter and the Pitot tube is explained in detail; weirs, current meters, floats, and travelling screens are also dealt with, and the salt solution method is discussed at considerable length.

The members of the committee were Profs. A. H. Gibson, S. M. Dixon, and F. C. Lea, Dr. W. C. Unwin, Mr. J. S. Highfield, and Mr. Evan Parry.

The Disintegration of Matter.—In a letter to *Nature* of March 29th Sir Ernest Rutherford and Mr. J. Chadwick refer to their experiments on the bombardment of elements with α-particles, resulting in the ejection of hydrogen nuclei from boron, nitrogen, fluorine, sodium, aluminium, and phosphorus, and state that they have devised a simple method by which they can observe with certainty the disintegration of an element when the ejected particles have a range of only 7 cm. in air. In this method a powerful beam of α-rays falls on the material to be examined, and the liberated particles are observed at an average angle of 90 deg. to the direction of the incident α-particles. They can now detect particles of range more than 7 cm. with the same certainty as particles of range above 30 cm. in their previous experiments; the presence of hydrogen in the bombarded material has no effect. Gases can be examined as well as solids. By this means they obtained H particles of range above 7 cm. from neon, magnesium, silicon, sulphur, chlorine, argon, and potassium. No detectable effect beyond 7 cm. was obtained from hydrogen, helium, lithium, carbon, and oxygen. The authors hope to make a systematic examination of the elements with an improved counting microscope.

A Refrigeration Congress.—The Fourth International Congress of Refrigeration is to be held in London from June 16th to 21st, under the presidency of Sir Gordon H. Campbell, K.B.E. Visits will be made to refrigerating establishments and other places of interest in London, Bristol, Southampton, Liverpool, and Manchester, to which the railway companies are granting a free Congress trip, and the leading shipping companies are entertaining the members on vessels in dock. A large volume of proceedings will be issued afterwards to members. Particulars relating to membership may be obtained from Mr. J. Raymond, Hon. Secretary-General, Fourth International Congress of Refrigeration, Weavers' Hall, 22, Basinghall Street, London, E.C.2.

Institution Notes.

Institution of Electrical Engineers.—Informal Meetings Section.—At the informal meeting on April 14th, Mr. W. E. Warrilow was in the chair, when Mr. J. R. Bedford opened a discussion on "Some Idiosyncrasies of Electrical Manufacturers." Mr. Bedford detailed a number of instances in which the manufacturers had not given sufficient attention to design. The importance of keeping down works costs very often resulted in a lack of finish or spacing that was very expensive in ultimate cost to the user. Referring to the Wembley exhibition and the hopes entertained of stimulating foreign and Colonial business, Mr. Bedford hoped that the experiences of the Home buyers in many instances would not be those of the oversea buyers of British goods.

A number of speakers contributed to the discussion, and the opinions of the user, contractor and manufacturer were all voiced. Messrs. J. F. Avila and P. Rosling gave instances of the way production was harassed by the imperative need for keeping costs low. Nobody liked mean work or giving ungenerous service, but it was the nature of the buyer to object even more strongly to paying for service. Messrs. H. Brown, J. T. Bedford, J. Coxon, W. Day, D. Dixon, V. N. Halliday, A. F. Harmer, A. G. Hilling, R. V. Hook, A. Kirk, O. F.

Mounsdon, F. Pooley, W. Riggs, W. E. Rogers, F. P. Sexton, W. E. Twells, W. E. Warrilow, M. Whitgift, and W. L. Wreford also spoke.

This was the concluding meeting of a very successful session. The papers have been of a high standard, and the discussions have been well maintained, with an average attendance of over 50.

Coopers' Hill Prize.—The Coopers' Hill War Memorial Prize has been awarded to Mr. F. R. Combes for his monograph on "An Historical and Critical Survey of Atmospheric Electricity and Protection against Lightning."

National Certificates.—The current I.E.E. *Journal* contains a further list of 25 schools and colleges that have been approved for the award of national certificates and diplomas in electrical engineering.

Mersey and North Wales (Liverpool) Centre.—On April 14th, at the University of Liverpool, an informal discussion on domestic electrical appliances, illustrated by lantern slides, was opened by Mr. J. W. Beauchamp, there being an attendance of about 250, including many ladies. During the evening an extensive exhibition of lighting, heating, cooking and wireless apparatus in action was arranged in the University by the Electricity Supply Department, the local contractors, and the University helpers, electrically-cooked refreshments being served.

Junior Institution of Engineers.—Water-tube Boilers.—When Mr. L. M. Jockel's paper on "Water-tube Boilers" was discussed on April 11th, many arguments for and against powdered fuel were heard. Mr. Jockel had suggested that the boiler of the future would use powdered fuel, and would have the furnace refractories cooled by the feed water. Mr. Charles Erith pointed out that water cooling in the furnace was a very difficult proposition, and in cases where the whole of the furnace walls were water-screened, a very considerable proportion of the steam was generated in these accessory boiler-heating surfaces, which constituted a sort of huge "birdcage" extension of the boiler proper. Powdered fuel only increased these difficulties. He said that he thought the boiler of the future would be of the simplest character, stoker-fired, and without water screens, furnace arch, or flue gas-air heater, the air for combustion being heated by using hollow furnace walls.

Mr. R. F. Evans put forward some of the advantages which powdered fuel gave in spite of its cost. He said that this was the era of bigger turbines and consequently bigger boilers, and one immediate effect of powdered fuel firing was that it increased the capacity of a boiler.

Mr. F. D. Napier mentioned the subject of circulation which, he said, had not always received sufficient consideration. As far as steam-raising ability and ultimate capacity were concerned, the important factor was circulation.

The discussion also centred around the question of air preheaters, and Mr. R. H. Allen and Mr. Lindhirst gave particulars of the "Thermix" and "Ljungström" air preheaters respectively. Mr. Allen said that boiler temperatures were not increased by using preheated air so much as was imagined. It was said that trouble from deposit on the heating elements occurred only rarely, generally when using bad coal, and any deposit, which was usually only fine ash, could easily be removed by a jet of steam or by increasing the flue gas velocity. Mr. Jockel gave details of a new test on a "Ljungström" preheater, showing a saving of fuel to the extent of 13.6 per cent., after taking into account the energy absorbed by the fans. Mr. R. H. Parsons, who was in the chair, mentioned the excellent efficiency which was being obtained at the Barton power station, and said that such efficiencies would probably become more common in this country with the advent of bigger stations.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

According to a Sydney newspaper just to hand, Mr. W. H. Myers, B.E., M.I.E., Aust., chief assistant electrical engineer for New South Wales Railways and Tramways, was to leave Sydney early in March by the *Ventura* on a visit to America and Europe to investigate a number of matters connected with electric power and traction. Mr. Myers is one of the representatives of the Commonwealth Government at the World Power Conference.

According to the *Commonwealth Engineer*, Mr. F. M. Nicholl, formerly of the Tasmanian hydro-electric department, and more recently city manager of Launceston, has been appointed sales manager to the Victorian Electricity Commission.

Mr. William H. Taylor, general manager of the Government tramway and electricity supply undertaking at Perth, Western Australia, was leaving for London by the s.s. *Omah* on Wednesday last, April 23rd, in connection with extensions to the West Australian Government electric supply power station at East Perth and other matters relative to the Department and to the tramways. He has also been appointed one of the delegates to represent Australia at the World Power Conference. He is expected to arrive here early in June, and his address will be c/o Agent General for Western Australia, Savoy House, London. Mr. Taylor is a member of the Standards Committee for Power Supply in Australia, whose work constitutes a Commonwealth investigation of an important character. Mr. Taylor, who is looking forward to meeting many old friends while here, is accompanied by his wife and boys. He will visit the Continent and return via America.

Paisley Corporation has granted permission to its burgh electrical engineer, Mr. Blair Smith, to give expert advice to the Inverness Town Council in connection with the proposed purchase of the electricity undertaking from a private company.

Swindon Town Council has decided to grant £250 extra remuneration to the borough electrical engineer, Mr. A. J. Howard, for services rendered in connection with the change of frequency of electricity supply.

The Kirkcaldy Town Council, at its last meeting, acceded to a request by Mr. Francis, its electrical engineer and tramway manager, who asked, in view of the recently increased output of electricity from the Corporation power station, that his salary should be increased. It was decided to advance it by £100 per annum to £708.

Mr. J. D. Watson, of Aberdeen, has been appointed assistant mains superintendent to the Electricity Department of the Preston Corporation.

The *Daily Telegraph* states that during March the following appointments and promotions were confirmed in the Board of Trade:—Mr. A. Simpson to be his Majesty's Trade Commissioner (Grade II) at Sydney; Major Guy Fetherston, D.S.O., M.C., to be his Majesty's Trade Commissioner (Grade II) at Cape Town.

The Council of the Institution of Production Engineers announces, with regret, the resignation of its secretary, Mr. A. T. Davey, necessitated by his leaving London to take up a position with Messrs. W. H. Allen & Sons, Ltd., of Bedford. The honorary secretaryship will in future be filled by Mr. E. D. Ball, 20, Lushington Road, Harlesden, N.W.10, to whom all communications should be addressed.

Obituary.—Mr. R. F. Hayward.—The death occurred on April 10th, in London, at the age of 58 years, of Mr. Robert Francis Hayward, who was until recently general manager of the Compañia Chilena de Electricidad, in Santiago, Chile. From 1890 to 1894 Mr. Hayward was works manager of Messrs. Crompton & Co., at Chelmsford, and then went to the United States as general manager of the Salt Lake and Ogden Gas and Electric Light Co. Other positions subsequently held by Mr. Hayward were chief engineer of the Utah Light and Railway Co., general manager of the Mexican Light and Power Co., and chief engineer and general manager of the Western Canada Power Co. He was a member of both the Institution of Electrical Engineers and the American Institute of Electrical Engineers.

Mr. C. A. Unbehaun.—The *Commonwealth Engineer* reports that Mr. C. A. Unbehaun, who was responsible for the introduction of the telephone into South Australia, died early in February at the age of 73. "He was transferred from the New South Wales to the South Australian telegraph department in 1887. The first telephone exchange in South Australia was opened in Adelaide in 1884."

Mr. H. J. Bullock.—The above contemporary also records that Mr. Harold John Bullock, station superintendent of the municipal tramways trust, Adelaide, passed away on February 15th, after an illness extending over five and a-half months. The deceased, who was 47 years of age, joined the staff of the municipal tramway trust in July, 1909, as electrician. In July, 1917, he was made superintendent of the power station, Port Adelaide, and converter stations, which position he held at the time of his death. He was an Associate Member of the Institution of Electrical Engineers.

Mr. Henry Smith.—We regret to record the death, which occurred on April 18th at Kensington, of heart failure, after a short illness, of Mr. Henry Smith, aged 76. He was a member of the Institution of Civil Engineers, member of the Institution of Mechanical Engineers, &c., and for many years a director of James Simpson & Co., Ltd., and Worthington Simpson Co., Ltd.

Mr. R. Baker.—We regret to record the death of Mr. Robert Baker, who was, until his retirement about seven years ago, gas and electricity fittings superintendent to the Bolton Corporation. He had been connected with the Corporation for over 40 years. Mr. Baker, who passed away on the 19th inst. in his 76th year, leaves three sons, two of whom are connected with electricity supply work: Mr. F. N. R. Baker, borough electrical engineer at St. Helens, and Mr. W. R. Baker, managing director and secretary of the Stratford-on-Avon Electricity Co., Ltd.

Sir A. J. Leppoc Cappel.—We have to record the death, which occurred on Sunday last in London, at the age of 87 years, of Sir Albert J. Leppoc Cappell, K.C.I.E., M.I.E.E., a director of the Eastern and Eastern Extension Telegraph Companies, also of the Globe Telegraph & Trust Co., Ltd., the Western, West Coast of America, Direct Spanish and other telegraph companies. As a telegraphist, he saw service in the Crimea, and subsequently received an appointment in the Indian Telegraph Service, rising after many years to the position of Director-General. He was knighted in 18[illegible]

New Companies Registered.

Apollo Wireless Co., Ltd. (197,272).—Private company. Registered April 14th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in instruments, apparatus and accessories used in connection with radio or wireless telegraphy and telephony, &c. The permanent directors are:—T. V. West, "The Dinney," Minsterworth, Glos.; Mrs. Mabel E. West, "The Dinney," Minsterworth, Glos.; G. Taylor, 2, Western View, Hayes, Middlesex. Qualification, 50 shares. Secretary: T. V. West. Solicitor: F. Treasure, St. John's Chambers, Gloucester. Registered office: 33k, Trading Estate, Slough, Bucks.

Krasa and Co., Ltd. (197,277).—Private company. Registered April 14th. Capital, £2,000 in £1 shares. To acquire the business of a merchant and manufacturers' agent now carried on by L. J. F. Krasa at 101-2, Hatton Garden, E.C., as "Krasa & Co.," and to carry on the business of merchants or importers of, or agents for and manufacturers of electrical goods or accessories, glass, china or porcelain ware, druggists' sundries and fancy goods, &c. The subscribers (each with one share) are:—C. Tofts, "The Holt," Farnham Common, Bucks., gent.; L. J. F. Krasa, 4, St. Cuthbert's Road, N.W.2, merchant. The first directors are to be appointed by the subscribers. Qualification, £100 shares. Remuneration as fixed by the company. Solicitors: E. G. Scott, Finsbury House, Blomfield Street, E.C.2. Registered office: 101-2, Hatton Garden, E.C.1.

Switchgear and Electrical Productions, Ltd. (197,279).—Private company. Registered April 14th. Capital, £3,000 in £1 shares. To acquire the business of makers of electrical switchgear, fuses, and other articles now carried on by S. C. Johnson and W. Wheelock at Excelsior Works, Ellis Street, Birmingham, as the "Electrical Productions Co." The permanent directors are:—S. C. Johnson, "Inglenook," School Road, Hall Green, Birmingham; W. Wheelock, 125, Oxford Road, Moseley, Birmingham. Qualification, £250. Remuneration, 15 per cent. of the net profits in each year divided between them. Solicitors: F. G. Darling, 38, Waterloo Street, Birmingham. Registered office: Excelsior Works, Ellis Street, Birmingham.

Watsham's, Ltd. (196,908).—Private company. Registered April 1st. Capital, £10,000 in £1 shares. To carry on the business of manufacturers of, and dealers in electrical accessories, apparatus, and appliances, &c. The subscribers (each with one share) are:—N. de M. Watsham, 33, King Street, W.C.2, engineer; H. Borradaile, Old Serjeants' Inn Chambers, 5, Chancery Lane, W.C.2, solicitor. The first directors are not named. Qualification, 500 shares. Solicitors: Woodham, Smith & Borradaile, Old Serjeants' Inn Chambers, 5, Chancery Lane, W.C.2. Registered office: 33, King Street, W.C.2.

Wombwell Electrical Contracting Co., Ltd. (197,218).—Private company. Registered April 11th. Capital £500 in £1 shares. To carry on the business of manufacturers, patentees, and workers of, and dealers in electrical plant, engines, machinery, implements, tools, fittings, appliances and accessories, cables, &c. The provisional directors are:—W. H. Mansall, Mill Grove, Millhouses, Sheffield, mining engineer; J. H. Gourley, 30, Kenwood Park Road, Sheffield, engineer. Qualification, £50. Secretary: H. O. Clarke. Solicitor: C. Hodgkinson, 6, Regent Street, Barnsley. Registered office: Hough Lane, Wombwell, near Barnsley.

H. E. Keen & Co., Ltd. (197,182).—Private company. Registered April 10th. Capital, £6,000 in £1 shares. To take over the business of an electrical engineer, contractor, and consultant carried on by H. E. Keen at 36, Great Smith Street, Westminster, S.W., as "H. E. Keen & Co." The permanent directors are:—H. E. Keen, 36, Great Smith Street, Westminster, engineer (chairman); V. Keen, 6, Atherstone Terrace, Gloucester Road, S.W., chartered accountant; G. L. Kirk, address not stated. Solicitors: Bate & Co., 35, Bedford Row, W.C. Registered office: 36, Great Smith Street, Westminster, S.W.1.

The British Western Union, Ltd. (197,265).—Registered as a private company on April 14th, with a nominal capital of £50,000 in £1 shares. The objects are: To acquire a cable steamship now in course of construction at Penheet, France, and intended to be called *Cyrus Field*, at present the property of the Western Union Telegraph Co. (incorporated in the State of New York, U.S.A., and having its head office in New York, with other offices in the City of London and elsewhere), together with all requisite equipment for the same; to construct, lay, maintain, and work submarine cables and land, wireless, and other telegraphs and telephones between and in Great Britain and Ireland and any other part of Europe, any colony or dependency of the United Kingdom, North and South America, China, Japan, and intermediate or other places, &c. The first directors are:—S. J. Goddard, Old Heathbourne, Bushey Heath, Herts., vice-president of Western Union Telegraph Co.; Rear-Admiral C. P. R. Coode, C.B., D.S.O., "Alvara," Alverstoke, Hants., general manager, European Division, Western Union Telegraph Co.; W. S. Scott, 85, Brooke Road, Stoke Newington, N., accountant. Solicitors: Johnson, Jecks & Colclough, 24, Austin Friars, E.C. The registered office is Western Union House, Great Winchester Street, E.C.

C. F. Palmer (London), Ltd. (197,253).—Private company. Registered April 14th. Capital, £5,000 in £1 shares (4,500 preference and 500 ordinary). To acquire the business carried on by C. F. Palmer at 403 and 405, Brixton Road, S.W., and to carry on the business of mechanical, electrical, and experimental engineers, electricians, manufacturers of, and dealers in physical, physiological, surgical, optical, and other scientific instruments, &c. The first directors are:—C. F. Palmer, 403-5, Brixton Road, S.W.9, mechanical engineer; B. F. Palmer, 91, Holmdene Avenue, Herne Hill, S.E.24, chartered accountant. C. F. Palmer is permanent governing director, subject to holding 100 shares, with power to appoint other directors, especially E. W. H. Ellis, E. G. E. Prentice, and R. N. Clarke, who have hitherto been employed by him. Registered by Geo. Reader & Co., 35, Coleman Street, E.C.

Veda Products, Ltd. (197,322).—Private company. Registered April 15th. Capital, £1,000 in 5s. shares. To acquire from T. Travers Hora the trade mark "Veda," No. 322,936, and to carry on the business of manufacturers of, and dealers in electric, magnetic, telegraphic, telephonic (radio or wireless), and other goods, &c. The subscribers (each with one share) are:—H. Hess, 19, Devereux Court, Strand, W.C.2, managing clerk; J. Evans, 19, Devereux Court, Strand, W.C.2, clerk. The subscribers are to appoint the first directors. Qualification, 20 shares. Solicitor: H. G. Taunton, 24, Strand, W.C.2. Registered office: 48, Pawsons Road, Croydon.

Official Returns of Electrical Companies.

H. G. Osborn, Ltd.—Particulars filed of £1,750 debentures authorised April 3rd, 1924, charged on the company's undertaking and property, present and future, the whole amount being now issued.

Mico, Ltd.—Debenture dated March 28th, 1924, to secure £350, charged on the company's undertaking and property, including uncalled capital, but excluding all loose plant and machinery not attached to the freehold, and fittings and fixtures. Holder: Mrs. W. H. Hawdon, 124, St. George's Terrace, Newcastle-on-Tyne.

Fallon Condenser Manufacturing Co., Ltd.—Debenture dated April 3rd, 1924, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. F. Fallon, 7, College Road, London.

Cutting Bros., Ltd.—Agreement dated March 17th, 1924, to issue debentures for £12,000 to rank *pari passu* with series for £22,000 already issued, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Mrs. A. Jobling, "Ricasoli," London Drift Road, Stamford, and others.

Roadrails, Ltd.—Charge on the net profits derived by the company's system at the British Empire Exhibition, Wembley, by the carriage of passengers and goods and sales of assets and effects (except rolling stock), and royalties, commissions, and moneys to be received in respect of patents, licences or assignments, dated March 27th, 1924, to secure £16,000. Holders: Sir Otto Beit, Bart., K.C.M.G., Baron Frederick D'Erlanger, the Duke of Abercorn, K.P., and Sir Henry Birchenough, Bart., K.C.M.G., all of 1, London Wall Buildings, E.C.

British General Radio Co., Ltd.—Particulars filed of £1,000 debentures authorised March 8th, 1924, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £600.

Andcole & Turner, Ltd.—Sir Maxwell Hicks, of 12, Grosvenor Gardens, S.W., was appointed receiver (on behalf of the debenture holders) of the company's undertaking and property, except uncalled capital by order of Mr. Justice Eve, dated April 11th, 1924, and also to act as manager of the company's business, but not so to act beyond May 23rd without the leave of the Judge.

Remco Carbon Co., Ltd.—R. Crane, of 46-47, London Wall, E.C.2, ceased to act as receiver on April 11th, 1924.

Radio Stocks, Ltd.—E. H. Hawkins, of 4, Charterhouse Square, E.C.1, and H. Foord, of 30, City Road, E.C.1, were appointed receivers on April 8th, 1924, under powers contained in charge dated November 22nd, 1923.

Brecknell, Munro & Rogers, Ltd. (79,766).—Return dated January 16th, 1924. Capital, £150,000 in 2,300 preference shares of £5 each and 278,000 ordinary shares of 10s. each. 2,058 preference and 174,829 ordinary shares taken up. 10s. per share called up on 160,767 ordinary and £5 per share on 2,058 preference shares. £90,673 10s. paid. £7,031 considered as paid on 14,062 ordinary shares. Mortgages and charges, nil.

Bullers, Ltd. (62,020).—Return dated January 11th, 1924. Capital, £400,000 in 20,000 ordinary and 20,000 preference shares of £10 each. 15,500 ordinary and 15,000 preference shares taken up. £150,070 paid on 7 ordinary and 15,000 preference shares. £154,930 considered as paid on 15,493 ordinary shares. Mortgages and charges, £235,250.

W. S. Laycock, Ltd. (68,203).—Return dated December 31st, 1923. Capital, £150,000 in 100,000 ordinary and 50,000 preference shares of £1 each. All shares taken up. £50,007 paid on 50,000 preference and 7 ordinary. £99,993 considered as paid on 99,993 ordinary shares. Mortgages and charges, £216,800.

Smithfield Markets Electric Supply Co., Ltd. (53,354).—Return dated March 12th, 1924. Capital, £100,000 in £1 shares. 60,000 shares taken up. £60,000 paid. Mortgages and charges, £19,170.

Electric Construction Co., Ltd.—Satisfaction to the further extent of £2,470 on April 8th, 1924, of trust deed dated December 16th, 1897, securing £300,000 4 per cent. perpetual first mortgage debenture stock.

City Notes.

English Electric Co., Ltd.

The report for the year ended December, 1923, shows a balance to the credit of profit and loss account (including £68,983 brought forward) of £330,776. From this are deducted:—Interest on 5½ per cent. sinking fund first mortgage debentures, £49,291; interest on 6 per cent. convertible debenture stock, £36,211; interest on 8 per cent. six-year secured notes, £63,408; trustees' fees, £443; dividend of 6 per cent. on the preference shares, £50,464; leaving £130,958. It is proposed to pay a dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, absorbing £61,244, leaving £69,714 to be carried forward. "During the year the technical and financial position of the company has been materially strengthened. The item in the balance sheet for interest in subsidiary companies exceeds that of the previous year by a figure which mainly represents the effect of exchanging debentures in one of our subsidiary companies for junior securities, principally ordinary and preference shares in the English Electric Co. Taking advantage of favourable financial conditions, your board redeemed the £1,250,000 8 per cent. notes (maturing on January 1st, 1927) by issuing 6 per cent. convertible debenture stock; and the balance, still outstanding, of the cost of this and all previous operations for the raising of capital is shown in the balance sheet as £90,067, which will be gradually written off. The result of the two operations actually conducted in the year has been an immediate reduction, as from 1924, of not less than £41,149 per annum in the debenture charges. The asset £316,004 shown in the balance sheet represents cash placed on deposit to redeem the balance of 8 per cent. notes which were still unredeemed on December 31st last; but the repayment is now practically complete. The orders taken during the year under review were very considerably in excess of the previous year, although the general level of prices left much to be desired. This increase in business is not fully reflected in the item 'Work in Progress' on account of a satisfactory reduction in general stock obtained during the year. Both at home and abroad the selling organisation of the company has been extended and adjusted to meet changing world conditions. New territories have been exploited and orders secured as a result which cannot fail to bring a steady and general increase in our business. The progress in the sections of the business devoted to railway electrification, steam and water power development schemes, mentioned last year, has been more than maintained, and our reputation correspondingly increased. The aircraft business of the company has been further strengthened by the establishment of a factory and sea base at Lytham, near Preston." Meeting: London, April 30th.

British Electric Transformer Co., Ltd.

The 21st annual general meeting was held on April 15th at Winchester House, E.C. Mr. A. F. Berry presided, and in dealing with the balance sheet, he said that stocks and materials and work in progress were about £43,000 more than at December, 1922. The increase was principally due to the greater amount of work in progress, and also to the larger stock of certain raw materials which they thought it advisable to hold. The profit and loss account showed that general charges had been decreased by about £2,900 only, while the gross profit on trading had dropped by just over £44,000. The loss on the twelve months' trading amounted to £22,129, which had to be increased by £4,000 to provide for depreciation of plant, &c. It was but little consolation to those of them who, as shareholders, had partly to live on their dividends, to be told that the loss incurred was forecast at the last general meeting. It was, however, of importance to all parties to be forewarned, but it was unpleasant for him to forecast that loss, and still more so to dwell upon the fact that they were unable to avoid it. Had they not adopted the directors' recommendation in the past for building up a reserve account out of profits, they would now be faced with a loss of about £26,000 to wipe off their future profits before they could return to the dividend-paying stage. As it was, they had written off the loss, still had a substantial reserve, and had started again to earn some profit. The orders in hand at December last, which were booked at prices on a more remunerative level than previously, could not all be executed before June 30th next, when their half-year ended, but it was hoped that the execution of these orders before the end of the year would enable them to show an improved result for that year and bring up the question of the payment of the preference dividend. Those expectations could only materialise provided they could carry on without loss of time or interruption, and were allowed to concentrate on the business of the company. Having referred to the resignation of Mr. H. Rowe as a director and the appointment of Mr. S. S. Lamert to fill the vacancy, the Chairman said that one of the first questions shareholders would naturally ask was: "To what is this loss that we have sustained really due?" Prompted by that main question might be suggestions of a querulous order: "Is the loss really due to causes beyond human control, or is it rather misguided optimism, an inflated basis of operations, bad debts or other defalcation of customers, or has there been any fundamental change of a drastic nature in the conduct of the company's affairs?" He wanted to put in as simple a manner as possible a statement outlining still further the position as given last year, when the present results were forecast and shareholders were told that it would be well into this year before the company again reached a profit-earning state. Everyone knew that the outstanding problem to-day for the nation was unemployment, due to an unprecedented slump in trade, practically all trades being affected. The portion of the industry dealing with electricity supply was now prospering, but the manufacturing section was suffering generally from a serious diminution of profits. The paucity of orders last year meant extreme competition for whatever work could be got; every reduction in price meant cutting away of profit; every reduction of output meant an added proportion of general charges to the little volume of business that remained. Reduced output and reduced prices therefore meant a double cut at their gross trading profit. The accounts of the company for the last three years showed a fall of this profit from £132,577 to £54,406 last year, and to £10,077 in the year under review. The general charges, on the other hand, were £45,000, £44,500 and £41,600 respectively for the same periods. It might be asked: Why not cut your general charges to bear a closer relation to your reduced gross profits? There were two main reasons why they could not do that. One was that their costs of obtaining work—where work was so difficult to get—were rather greater than in prosperous times, and customers demanded more attention to all sorts of detailed requirements in difficult times; in other words, it was the buyers' opportunity. Another reason was that in a business such as theirs where they had every reason to believe that by strenuous and united effort they could again reach dividend-paying times, it would be a grave mistake to dismiss efficient members of staff and so on, and generally tend to break up an organisation that had been built up through a long period and with difficulty and that would be needed still more in the future than it had been in the past. The main fact emerged that, as in other manufacturing business, the home trade fell right away, and the export business—what there was of it—was hardly worth taking up, as it usually entailed serious risk of loss on labour and materials alone. In connection with the low prices that had been ruling, it should be remembered that the reductions they had made in prices had encouraged electricity supply undertakings to purchase plant, and had helped them forward to better times and greater success. In turn, those customers of theirs would, it was hoped, with greater publicity, more uniform prices and larger turnover, be spurred to greater efforts and so bring orders to the manufacturers in increasing quantities. Shareholders would have very tangible evidence this year of the increasing propaganda and publicity undertaken by the electrical industry at Wembley, where something of the order of £1,000,000 was being expended to produce the greatest electrical show that they had ever engaged in. Shrewd observers might well wonder whether specialist electrical manufacturers, amongst whom they were prominent, would be able to cope fully with the demand which in due time must spring from all that development. With regard to the future, last year he told them that the half-year ended June 30th last was likely to be the period when they would be in the trough of their trade slump, and so it had come and gone. He thought they might hope to see prosperous times return again in spite of the difficulties ahead. He would like to warn them against undue optimism just as much as against undue pessimism, and to ask them to help the board to preserve an even keel so as to drive through the rough waters that they still had in front of them. Whatever else they did, he asked them not to put their trust in politicians to help industry over-much. It was the work of hand and brain alone that would secure to that or any other nation its daily bread. In his opinion, the company was neither over-capitalised nor over-built, and in a very few years' time he hoped it might prove that their present resources were taxed to deal sufficiently with the output. In saying that he was assuming that the English people as a whole was awakening to the fact that you must export a fair day's work if you wished to import a fair day's food. There was decided evidence of improvement foreshadowed for the present year's work. The second half of last year showed a loss of rather under one-tenth of that of the first half—that was over 90 per cent. of the loss was incurred in the first six months. Not only was the value of the orders, as at December 31st last, double that at which they stood at December, 1922, and also booked at better prices, but since then he had had the orders taken out to date, which was for about 3½ months, and already they were practically up to the first seven months of 1923 in amount, and from the point of view of profit value he hoped and believed there was more than that in it. The future was always on the lap of the gods, and there was very much that was still obscure with regard to this country's future. There was a hopeful sign in the steadying of exchange in various parts of the world, and that would be of value to the country from an exporting point of view. Electricity was daily being used for an increasing number of domestic and industrial purposes. That extended use brought added appreciation of its value, and at any rate they were safe in believing that the electrical world would be able to earn its bread and butter with a bit of jam if the rest of the industry of the country could make its living. In other words, theirs was a growing industry, with very great prospects not too far removed. Mr. S. Berry seconded the motion, which was unanimously adopted after a short discussion.

British Engine, Boiler & Electrical Insurance Co., Ltd.

The directors report that during the year they refunded to members of the staff £8,785 originally transferred by the staff to the company to form the nucleus of the Pension Fund, and this evoked much satisfaction. The Pension Fund having been depleted by this payment, £20,785 has been transferred to it, and a contingency fund has been created, £10,000 having been transferred thereto from the profit and loss account. An interim dividend of 10s. per share (less income tax) was paid last July, and after giving effect to the above transfers there remains a balance in profit and loss account of £27,165, out of which a final dividend of 16s. per share (less income tax) is to be paid, absorbing £12,648.

Birmingham District Power and Traction Co., Ltd.

The annual meeting was held on April 15th under the chairmanship of Mr. C. Shirreff Hilton. In moving the adoption of the report and accounts (*vide* Elec. Rev., April 11th, p. 587), the chairman said that the strong financial position of the company had been maintained. Strict economies in operation had resulted in a larger net revenue, although the tramway companies' receipts were lower. The car-mileage and number of passengers carried showed a substantial increase, but these figures would probably be reduced considerably at the end of 1924, as the control of the tramways worked by the company in West Bromwich had passed into the hands of the Birmingham Corporation. The chairman expressed the hope that a satisfactory return would soon be obtained upon the company's large investment in the Shropshire, Worcestershire, and Staffordshire Electric Power Co. The subsidiary tramway undertakings all showed fairly satisfactory results. The competition from omnibus undertakings had been carefully considered, and steps were being taken to protect the tramways from unnecessary and wasteful competition.

Pernambuco Tramways and Power Co., Ltd.

Mr. Follett Holt, M.Inst.C.E. (chairman), presided at the annual meeting on April 15th, and, in presenting the report and accounts (see Elec. Rev., April 18th, p. 627), said that they afforded good evidence that their confidence in the soundness of their venture was being justified. Heavy capital expenditure and fixed charges had been incurred at the outbreak of the war, and the fall in the value of the milreis, from 16d. to as low as 4½d., had caused considerable difficulty. During 1923, however, the net results improved by 67 per cent. in milreis and 28 per cent. in sterling. Concessions and rates had been adjusted to meet the altered conditions, and the company found itself in possession of a live and expanding business with good prospects before it. If progress was maintained at the present rate, not only would they have wiped out the accumulated deficit at the end of the year, but they would have a satisfactory balance over and above the fixed charges.

During the year a new 3,000-kW set had been installed in

the power house; this provided a good reserve. After briefly dealing with the gas undertaking, the chairman turned to the telephone system of the city in which the company had an interest. He said that the rates were too low and the concession too short to justify its reconstruction. Means were being explored by which the city and suburbs of Pernambuco might be provided with the efficient service which was so necessary.

South Wales Electrical Power Distribution Co. The South Wales Power Co., Ltd., operated the commercial side of the undertaking during 1923, and a detailed revenue account has therefore not been submitted. The limited company's accounts showed a credit balance of £64,384. After charging debenture interest and depreciation, there remained £7,008, which has been carried forward to suspense account No. 1, making the total at the credit of this account £7,712. The arrangements to terminate the working agreements with the South Wales Power Co., Ltd., and to revest the administration in this company will be carried into effect when the exchange of stocks and shares has been completed. Meeting at Cardiff to-day.

Cuba Submarine Telegraph Co., Ltd. The report states that the receipts during 1923 were £57,009 and the expenses £25,215. After providing for cable repairs, income tax, and Corporation profits tax, there remains a balance of £18,103, to which are added £6,629 brought forward and £2,374 difference in exchange, making £27,106. The general reserve receives £6,000 and a final dividend is paid on the ordinary shares, making the year's distribution 5 per cent. free of tax; £7,106 is carried forward. During the year under review the Imperial Conference approved a proposal to establish a new line of communication with the Lesser Antilles and British Guiana. Contracts have been placed for a joint cable and radio service which is expected to be working in June next. In view of the effect that this may have upon the company's revenue it has been deemed advisable not to pay a bonus on the ordinary shares. Meeting: April 29th.

Dublin (Electric) Tramways Co. An extraordinary general meeting of this company confirmed the resolution, already passed, authorising steps to be taken to promote legislation for the maintenance of omnibus services in the city and in the counties of Dublin, Wicklow, and Kildare. Mr. E. Collins said that in this matter they were guided by the advice of counsel. Mr. W. Hewat, who presided, said it was absurd that the companies could not do what anybody else could do by merely taking out a licence. The city was extending outwards and the need for 'buses existed in districts where it would not in the first instance pay to lay down tramway lines. He (Mr. Hewat' could not understand why the Dublin Corporation had intimated opposition to the proposed Bill, as it would be recognised that the company had a reasonable claim to the facilities.

Spanish Companies. The report for 1923 presented to the general meeting of the Union Electrica Vizcaina showed gross receipts 5,562,486 pesetas, from which, deducting general and maintenance charges and pensions (65,000 pesetas) and statutory payments, a sum of 4,837,787 pesetas resulted. Setting aside half of this sum as payment for current supplied by the Hidroelectrica Iberica, the available balance was allotted as follows: 3 per cent. dividend, 810,000 pesetas; 4 per cent. dividend, 1,080,000 pesetas; sinking fund, 150,000 pesetas; taxes, 400,000 pesetas; leaving a carry over of 705,616 pesetas. During the year the company had invested 1,870,619 pesetas in extensions of plant, including overhead lines, alternate current underground lines, and new transformer posts. The continuous current networks for public lighting had absorbed 1,243,387 pesetas. A new 1,000-kW group of converters had also been installed. During the year the Braga substation had been started, and a second turbo-generator group installed at the Fall of Lindoso. Twenty- to 22-metre high metal columns were replacing the wooden posts on the transport line from the Lindoso Falls to Braga and Oporto, the work being expected to be finished in the course of the present year. The contract with the municipal authorities of Oporto for the supply of current to that city and the textile industry located there was signed in October, 1923. The affairs of the Empresa Portuguesa Electra del Lima, in which the Union Electrica had an interest, were proceeding satisfactorily.

La Société des Tramways et Electricité de Bilbao, which has a capital of 7½ million francs, reports a net profit of 1,806,113 fr. for the last financial year, as compared with 1,802,827 fr. in 1922.

French Companies. The Société de l'Energie Electrique du Sud-Ouest reports a net profit of 4,555,960 fr. for last year, as compared with 3,919,700 fr. in 1922. A dividend of 8 per cent. is being paid on the preference shares and 7 per cent. on the ordinary shares.

A net profit of 735,572 fr. is reported for last year by the Société des Forces Motrices de l'Auvergne, as compared with only 417,764 fr. in 1922. A dividend of 10 per cent. is being declared.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the committee under Rule 159:—

American Telephone and Telegraph Co.—$12,273,700 capital stock

Egham and Staines Electricity Co.—40,000 ordinary shares of £1 each, fully paid (Nos. 1 to 40,000), 40,000 7½ per cent. cumulative preference shares of £1 each, fully paid (Nos. 40,001 to 80,000), and 35,000 new 7½ per cent. cumulative preference shares of £1 each, 10s. paid (Nos. 115,001 to 150,000).

Enfield Cable Works.—202,056 ordinary shares of £1 each, fully paid (Nos. 1 to 202,056).

City Electric Light Co., Ltd. (Brisbane).—The annual meeting was held at Brisbane on March 19th, when the report for the year ended January 31st, 1924, was submitted, showing a credit balance of £106,408. An interim dividend was paid in September last, amounting to £51,025, and a further dividend of 3 per cent. on the 6 per cent. preference shares, 3½ per cent. on the 7 per cent. preference shares, and 5 per cent. on the ordinary shares, free of State tax, was recommended, absorbing £55,367, and leaving £105 to be carried forward.

Indo-European Telegraph Co., Ltd.—The report for 1923 states that the company's through route for international traffic was reopened from the United Kingdom on August 3rd last, and has since carried good traffics in a satisfactory manner. The accounts for 1922 were to be presented at the annual meeting yesterday, but those for 1923 are not yet ready. A final dividend of £1 2s. 6d., free of tax, was recommended, making 7 per cent. for the year, free of tax. Mr. H. L. M. Tritton has been appointed chairman, and Sir Rayner C. Barker, C.I.E., has also joined the board.

Hadfields, Ltd.—The report of the directors for 1923 states that the continued depression in the steel and engineering trades accompanied by severe cutting of prices has adversely affected the earnings of the company. The programme decided upon for the adaptation of the plant and buildings erected during the war, to suit post-war production, has now been practically completed. A dividend of 4 per cent., less tax, is recommended on the ordinary shares, a balance of £106,635 being carried forward.

Agricultural and General Engineers, Ltd.—On April 15th a series of meetings of the various classes of shareholders was held to consider the reduction of the company's capital from £8,000,000 to £6,757,184 by the methods outlined in our issue of April 4th (p. 548). General approval was given to the scheme, which was confirmed at a subsequent extraordinary general meeting.

Great Northern Telegraph Co., Ltd., of Denmark.—For the year 1923 the directors recommend the distribution of a total dividend and bonus of 22 per cent., including the 5 per cent. already paid, and to transfer £33,333 to the reserve and renewal fund; £55,556 to the pension fund, and carry forward £312,078.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.— The net receipts for 1923 were £168,874, and after meeting expenses and adding £37,747 brought forward, a balance of £130,708 is available. A dividend of 4 per cent. (the first since 1918) is to be paid on the "B" ordinary shares, leaving £44,619 to be carried forward.

Fife Tramway, Light and Power Co.—The company intends on July 1st, 1924, to repay the whole of the outstanding 7 per cent. debenture stock, and accordingly on that date the stock will become repayable at the rate of £102 for each £100 of stock, with interest to the date of redemption.

Belgian Company.—The Société de l'Electricité du Pays de Liége, which has a capital of 10 million francs, reports a net profit of 2,274,162 fr. for the last financial year as compared with only 1,844,050 fr. in 1922.

Brazilian Traction, Light & Power Co.—Quarterly dividend of 1 per cent. on the ordinary stock, payable June 2nd.

Stocks and Shares.

Tuesday Evening.

The Stock Exchange always hopes, yet seldom expects, that business will be brisk immediately after the Easter holidays. There is certainly a fair amount of postal trade to deal with, but this is largely concerned with pure investment, and business, generally speaking, takes a day or two to recover from the effects of the longest public holiday in the year. Prices to-day, however, have been decidedly firm, the features again reproducing those of the last two or three weeks, in that investment stocks make the best showing, the speculative departments coming in for more inquiries than orders. We directed attention recently to the securities guaranteed under the Trade Facilities Acts of 1921 and 1922, and the only bar to activity in these issues is the difficulty which exists of obtaining stock to satisfy buyers. There is, however, about £5,000 Central London 4½ per cent. second debenture stock, 1942-74, obtainable at a little under 96, guaranteed by the Imperial Government. On the other hand, the City & South London debenture, London Electric Debenture and Tata Power 4½ per cent. Guaranteed, all of these carrying the Government guarantee, are difficult to buy because there is so little stock in the market.

The Madras Electric Company had no difficulty in placing its £130,000 5½ per cent. debenture stock, the subscription lists being open for a day only. The company's report has just appeared, and the ordinary dividend has been raised from 7 per cent. to 10½ per cent. free of tax. This put up the price of the shares to 23s. 9d. The directors have given notice to redeem the £50,900 which is still outstanding of the 5 per cent. debenture stock.

This week's opening of the British Empire Exhibition has given a strong fillip to the previous buying of Underground Railway stocks. Metropolitans have risen 4½ points to 82½ and Districts are 2½ up at 54½. Apart from ½ rise in the £10 shares, there is no change in the Underground issues, though it may be said that the unfavourable effect produced by Lord Ashfield's statement, made during the 'bus strike, with regard to the earnings of the transport companies, has practically worn off. Underground Income Bonds are being talked, as they say in the Stock Exchange, to 100, and as the interest is paid free of tax, the bonds are worth including in any list of speculative investments.

The General Electric Company's claim against the German Clearing Office for approximately £300,000 has been decided in favour of the G.E.C., and in sending out the notice, the company added that this decision will "materially strengthen its investment account and reserve." Last year, it may be recalled, 5 per cent. dividend was paid on the ordinary shares, and the directors act very fairly in adding the above rider to the announcement regarding the £300,000, some of which amount the shareholders might otherwise have expected to be distributed to themselves in the way of dividend. There can be no question that the prudent policy is to place this money to reserve.

Small declines in several of the London electricity supply shares are the result of sentiment, previously quoted here, that the companies may have reached something like the full flood of their excellent dividends, and that the prospects in the immediate future do not flatter the idea that there is likely to be further expansion. Shareholders are a little afraid that, in the negotiations connected with the various Parliamentary Bills, the electricity supply companies will have to submit to a sliding scale of charges, in the same way that the gas companies did before the war. Hence, in spite of a vague impression that the present Government may not remain in power for long, there are falls in City Lights, County, Charing Cross, and one or two other companies' ordinary shares. Edmundsons make an outstanding exception to the general tendency, having risen 5s. to 4½. London Electrics are now quoted in their £1 shape and stand at 31s.

Cable stocks maintain their rises. Both Westerns and Globe ordinary have added 2s. 6d. to their quotations. Anglo-American deferred at 23¼ is 12s. 6d. better and a good market. Indo-Europeans at 32½ are unaffected by the announcement of the final dividend of 22s. 6d. per share free of tax, making 7 per cent. free of tax for the year. This is the same as the 1922 distribution. A dividend which attracted more attention is the Babcock & Wilcox final of 5 per cent. free of tax, with a 2 per cent. bonus, making 12 per cent. tax-free for the whole year. For the previous twelve months, 20 per cent. was paid, but as the present 12 per cent. is on double the capital, there is actually an improvement in the position.

Edison-Swan 5 per cent. debenture is better at 78½. India Rubber shares went back to 13s. 9d. Vickers new debenture stock, after being down to 1½ discount, recovered to ¼ discount. It was thought that the previous fall was caused in part by the pressure to sell on behalf of people who applied for the stock as stags and did not care to face the call which is now becoming due. River Plate Electric ordinary stock has risen 4 to 154½. Yorkshire Electric ordinary rose to 19s. 6d.

Potteries Electric Traction, which have been a difficult market for some time past, are quoted lower at 5s. middle. London United Tramways debenture stock at 49 is a point down. In the foreign group, British Columbia stocks continue to advance, and Brazilian Tractions at 58 show a small rise, after having been down to 57. North Metropolitan Tramway 5 per cent. debenture stock is marked up 3 to 97½. Tokyo Electric Sixes fell rather sharply to 89½, in consequence of the friction that has broken out between the United States and Japan, with the result that the Japanese exchange gave way abruptly. The rubber market is quiet, but a diminutive rise in the price of the raw produce served as a set-off to two or three rather disappointing reports published during the past few business days.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price April 22, 1924.	Rise or fall.	Yield p.c.
Brompton Ordinary	1	12	10	37/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	29½	—2/-	6 16 6
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	1⅝	—	6 8 0
City of London	1	15	15	45/9	— ¼	6 11 0
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
County of London	1	10	15	45/9	— 1¼	6 11 0
do. do. 6 % Pref. ...	1	6	6	1⅛	—	5 6 8
Edmundson's Ordinary	3	7	7	4½	+ ½	4 9 0
do. 6 % Pref.	5	6	6	5½	—	5 17 1
Kensington Ordinary	5	12	14	10	— ½	7 0 0
London Electric	1	10	10	31/-	—	6 9 0
do. do. 6 % Pref. ...	5	6	6	5½	—	5 11 7
Metropolitan	1	8½	10	1½	— ¼	5 11 3
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	19/6	—	6 3 1
do. 5 % Pref. ...	1	5	5	16/9	—	5 19 1
do. 7 % Pref. ...	1	7	7	23/6	—	5 19 1
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	—	—	1	—	Nil
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	13½	—	6 13 4
South London	1	11	15	42/3	—	6 18 10
South Metropolitan Pref. ...	1	7	7	1¼	—	5 12 0
Westminster Ordinary	5	12	15	10⅜	— ½	7 1 2
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	20/6	—	7 6 4

Home Rails.

Central London Ord. Assented Stock	4	4	68½	—		5 16 10
Metropolitan ... ... ,,	3½	4	82½	+4½		4 17 0
do. District ... ... ,,	3	3½	54½	+2½		6 8 5
Underground Electric Ordinary	10	Nil	Nil	2⅞	+ ½	Nil
do. do. "A" ...	1	Nil	Nil	7/6	—	Nil
do. do. Income Bonds	5	6	97	—		*6 3 9

Telegraphs and Telephones.

		Dividend. 1921	Dividend. 1922			
Anglo-Am. Tel. Pref. ... ... Stock	6	6	102½	+ ½		5 17 1
do. Def. ... ... ,,	1½	34/6	23½	+ ⅜		6 9 0
Chile Telephone	5	6	6⅜	—		4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 3
Eastern Extension...	10	10	10	17	—	5 17 8
Eastern Tel. Ord. ... ... Stock	10	10	172½	—		5 16 0
Globe Tel. and T. Ord.	10	10	10	17⅞	+ ⅛	5 12 0
do. do. Pref.	10	6	6	10⅞	—	5 11 7
Great Northern Tel.	10	24	22	28	—	7 17 2
Indo-European	25	10	7	32½	—	*5 7 8
Marconi	1	25	15	1⅜	—	9 4 6
Oriental Telephone Ord.... ...	1	12	12	1⅜	—	*6 17 3
United R. Plate Tel.	5	8	8	6⅞	—	*5 16 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	17	+ ⅛	5 17 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref....	5	5½	19½	3⅜	—	8 9 0
do. do. 2nd Pref. ...	5	Nil	5½	2⅛	—	10 4 4
do. do. 5% Deb. ... Stock	5	5	73½	—		6 16 3
British Electric Traction Ord. ... ,,	4½	5	74	—		6 15 3
do. do. 6% Pref. ... ,,	6	6	99½	—		6 0 6
Brazil Traction 100	Nil	4	58	+ ½		6 18 0
Brit. Columbia Elec. Rly. Pcs. Stock	5	5	84½	+1		5 18 4
do. do. Preferred ,,	5	26/-	84½	+1		*5 14 0
do. do. Deferred ,,	8	127/-	101½	—		*6 8 3
do. do. Deb. ,,	4½	4½	78½	—		5 8 3
Lond. & Sub. Trac. 5 % Pref. ...	1	8½	5	6/-	—	8 6 8
London United Tram. Deb. ... Stock	4	4	49	—1		8 3 4
Mexico Trams. 5% Bonds ... —	Nil	Nil	73½	—		6 16 0
do 6% Bonds ... —	Nil	Nil	50½	—		Nil
Mexican Light Common ... 100	Nil	Nil	22½	—		Nil
do. Pref. 100	Nil	Nil	46½	—		Nil
do. 1st Bonds ... —	Nil	5	68½	—		7 6 0

Manufacturing Companies.

Babcock & Wilcox...	1	15	20	2⅜	+ 1/8	*5 1 1
British Aluminium Ord.... ...	1	10	5	23/3	—	4 5 10
British Insulated Ord.	1	15	15	2 7/16	—	6 3 0
Callenders	1	15	15	48/9	—	6 3 0
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	5/16	—	8 17 10
Edison-Swan	4/-	10	Nil	4/9	—	6 6 4
do. ,, 5% Deb. ... ... Stock	5	5	78½	+1		6 7 7
Electric Construction	1	10	10	1 5/16	—	6 7 6
English Electric	1	8	5	17/6	—	5 14 8
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 6
do. Ord.	1	10	5	20/6	—	4 17 7
Henley	1	15	15	2 7/16	—	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 9 1
India-Rubber	1	10	10	1 5/16	— 1/16	*7 5 0
Met.-Vickers Pref....	2	8	8	2 7/16	—	6 5 0
Siemens Ord.	1	10	10	16/3	—	Nil
Telegraph Con.	12	20	20	24	—	*5 0 0

* Dividends paid free of Income Tax.

Power Circuit Interference with Telegraphs and Telephones.

By S. C. BARTHOLOMEW, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from p.* 638).

Two methods of transposing telephone wires in order to prevent disturbance from telegraph circuits and cross-talk between the telephone circuits themselves are employed in this country. The older system is the "twist," in which four wires (two circuits) are taken as a unit and occupy at the insulators the four corners of a square, the diagonals comprising a circuit. At successive poles each wire changes its position to the next corner of the square, and thus in four spans completes a spiral, the twist being right-handed. The other is that employed in America by the American Telegraph and Telephone Co., in which the wires are run straight for a certain number of spans and their position is changed at definite points.

The transposition of power wires will not reduce the effects of residual voltages and currents except in so far as it effects an improvement by balancing the capacities to earth of the several conductors. It will, however, reduce the effects of balanced voltages and currents by producing mutually neutralising effects in neighbouring communication wires. Power wires on traction systems cannot be transposed. In the usual case it is a three-phase 3-wire extra-high-pressure line.

The Californian Commission's report limits the maximum length of "barrel" in the case of a single-circuit three-phase line to 12 miles for circuits of triangular configuration, and to 6 miles for other forms. Single-phase and two-phase circuits have to be transposed at intervals not exceeding 4 miles.

It should be an axiom that where parallelism cannot be avoided the greatest possible separating distance should be provided. This is important not only in connection with inductive effects resulting from the normal working of the power line, which may be small if proper precautions are taken, but because it is impossible to guarantee that some abnormal occurrence on the power system may not by its unbalancing effects cause serious disturbance.

As regards actual maximum tolerable values, those taken in the Californian report are no doubt near the mark in the case of telephones; that is, the extraneously induced current in the receiver should not exceed in its noise-producing value the effect of 10 micro-amperes at a frequency of 240 periods per second; but those taken in the case of telegraphs, *viz.* the extraneously induced current at the circuit terminals, should not exceed 2 milliamperes at a frequency of 60 periods per second, or its equivalent at any other frequency, *e.g.*, 1 mA at 25 periods per second appears to be on the high side, and the author would place the maximum figure at 0.5 milliampere for this country.

The presence of power circuits in the vicinity of telephone circuits necessitates an unusually high standard of maintenance of the latter. Small defects that would cause little trouble were the power circuit non-existent, now prove annoyances of considerable magnitude, whilst apparatus that was thought to be accurately balanced is found to be wanting when exposed to the searching effects of strong fields. This is specially noticeable if the apparatus is earth-connected, as the capacity discharges through the apparatus will effectively show up any want of balance in the impedances. Further, it is possible to have trouble even if the exposed telephone circuit be perfect in balance as regards insulation, capacity and conductor resistance, and taken alone no disturbance is experienced, as this circuit is liable to be placed in connection with any number of other circuits any one of which may be more or less faulty.

Various methods have been devised for reducing the effects of induction upon telephone circuits by modifications or alterations in the apparatus. None of these methods is suitable for public telephone circuits—the most that can be claimed for them to-day is that they may be of use in dealing with private lines.

It is possible to reduce the inductive effects on the working of telegraph apparatus within certain limits. Very small foreign currents are likely to mutilate telegraph signals.

The remedies that can be applied depend upon the values of the induced voltages. The most successful have been those based on the fact that telegraph apparatus is usually worked with direct current, and as the interfering current is alternating it is possible to arrange for the alternating current an easy path which is closed to the direct current, and, further, to arrange a path which is closed to the alternating current but open to the direct. There are, however, a few other methods.

The greatest success has been achieved with resonance shunts to duplex and simplex telegraph circuits in this country (fig. 5).

The different types of power circuit, *viz.*, tramway, railway, lighting, and power are next dealt with so as to indicate in a general way means of overcoming interference. If a tramway system is extensive, with substations feeding the system in common, disturbance is usually more severe owing to balancing current constantly flowing in the trolley wires and feeders between the substations. Improvement will usually result if the substations work independently, *i.e.*, if each feeds a portion of the system and there is no connection with other portions.

If the tramway undertaking has a stand-by battery at the station, the inductive disturbance will be reduced by placing the battery across the offending machine. The battery affords a low-resistance path for the ripples and, in addition, will tend to flatten the ripple in the external circuit by resisting changes due to the rise and fall in the voltage of the ripple. This method is not effective if there is an automatic booster machine in the battery connection. If the ripple is of a well-defined frequency it should be possible to shunt it at the machine by an arrangement of capacity and inductance tuned to the frequency of the ripple similar to the method described for use with mercury arc rectifiers.

The electric railways of this country are in the majority of cases worked with direct current, and the conditions giving rise to interference are electrically comparable with electric tramways.

The great increase of electric railways in London has not brought about a corresponding increase in disturbance to telegraphs, and the author attributes this to the fact that, coincident with this development, the Post Office brought the high-resistance polarised sounder into general use in London.

The direct-current system, as developed in recent years, has certainly produced unpleasant and unexpected features, but undoubtedly the general experience with single-phase railways in many countries has shown that system to be the worse offender. The lay-out of the system has a most important bearing in this connection and many varying methods have been adopted, some of which are described.

With 60 per cent. rail current, that is, 40 per cent. of the trolley current return flowing in the earth as stray current, the induced voltages per mile per 100 amperes in the trolley are in general about 10 volts, 5 volts and 1 volt, at 50 ft.,

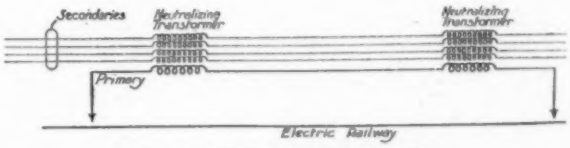


Fig. 6.—Neutralising Transformers.

300 ft. and 4,000 ft. separation respectively. Thus at 50 ft. separation with 1,000 amperes in the trolley a 10-mile exposure would result in an induced pressure of 1,000 volts. These are maximum figures, in that they are based on the assumption that power is supplied in one direction only.

To overcome the large induced voltages, "neutralising transformers" have been used on the telegraph and telephone circuits, with fairly satisfactory results, see fig. 6. The transformers give a transmission loss on all telephone circuits to which they are connected. That there is no appreciable "cross-fire" between the telegraph circuits working on the transformers will probably be the case with circuits worked at hand speed, but it is doubtful whether high-speed working would not be affected. The transformers are effective only in reducing voltage effects and have yielded no improvement in respect of the high-frequency noise in the telephone circuits. The transformers are very weighty, and they have to be protected by lightning arresters, which give considerable trouble. The railway company in one case subsequently altered its system of distribution.

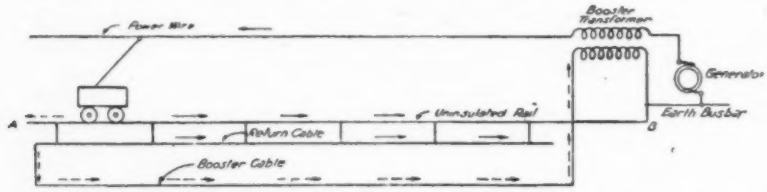
On the Brighton section of the Southern Railway a serious attempt has been made in the lay-out to prevent leakage and electromagnetic induction, and, although complete success has not been attained, the steps taken have undoubtedly minimised considerably the injurious effects likely to arise from those causes.

In spite of this arrangement (fig. 7), a considerable amount of trouble occurred with the opening of the section to the Crystal Palace and Tulse Hill. Other variations of the method all aim at reducing by means of boosters the current straying from the rails, with the addition in some cases of live connections which tend to neutralise further the effects of the current in the contact wire by providing return overhead conductors.

The author is, perhaps naturally, prejudiced against a system of electric traction which is likely to have such deleterious

effects on communication circuits, but he is not without hope that a satisfactory solution of the problem will be found. It has apparently not been found, so far, as a recent communication in the *Teknisk Tidskrift* states that the shifting of the telephone lines from the Stockholm-Gothenburg railway will cost 68 million kronor (say, £400,000) for the ordinary lines, and 17 million kronor (£100,000) for the railway communication lines. This fact is significant, following an inquiry by the Swedish Government into the matter.

Electric light and power systems are not allowed to have more than one earth connection on each distinct circuit, with certain few exceptions, and this restriction has an important bearing in preventing interference by leakage currents. Faulty insulation on a power system may not in itself actually result in leakage currents affecting telegraphs or telephone circuits, but may produce inductive disturbance owing to the unbalancing of the currents in the different conductors of the power system. So far as inductive effects are concerned, the great majority of electric light and power systems do not materially affect communication circuits.



The booster transformer produces between A and B an e.m.f. opposing that of current returning in the rail, return cable and earth, whilst providing an alternative low-resistance path through the booster cable.

——▸ Path for power circuit and return without booster. ·····▸ Return current with booster.

Fig. 7.—Booster and Booster Cables—Southern Railway (Brighton Section).

The method of connection has a very important bearing on the possibility of producing interference owing to the development of the third harmonic or multiples thereof. In star-connected three-phase systems with the neutral point earthed, the third harmonic in each of the conductors is in phase and this causes an alternating voltage to appear between conductors and earth of a frequency three times that of the fundamental. With only one earth on the system, *i.e.*, at the neutral point of the star winding, the three wires are raised or lowered in voltage simultaneously in respect to the earth, and the effect on neighbouring communication circuits is wholly electrostatic and, generally, telephone circuits only are affected. If the power system is extensive, however, and other conditions favourable, telegraph circuits may also be interfered with, as the charging current may be of considerable magnitude. If there be a second earth on such a system, a single-phase current will circulate between the two points over the three conductors in parallel, with the earth as return. This arrangement may be particularly undesirable from the point of view of interference.

Where a generator has the neutral point earthed and supplies power to an overhead line through transformers, the type of connection of the transformers is of great importance from the point of view of inductive interference.

The delta-delta is the best arrangement and star-star the worst. A tertiary winding in the latter case will reduce the inductive effects.

The conclusions are that although the inductive interference troubles cannot be said to be serious in this country, one can foresee that they may become so if due consideration is not given to the possibilities. Many interests are concerned and the author would place responsibility for solving the problems in the following order:—

First, the designer, who by producing machines free from harmonics can practically eliminate the whole trouble with telephone circuits.

Secondly, the power engineer, who can plan his system to be balanced as regards loads and lines, employ transformers with connections least likely to cause trouble and worked at a low magnetic density, and by proper precautions and maintenance reduce faults on his circuits.

Thirdly, the telephone engineer, who can do much by designing his circuits and apparatus in such a way as to reduce the possibilities of out of balance and by the proper maintenance of his lines.

Fourthly, the protective-gear engineer, who, last but not least, will prevent those breakdowns which result in very serious trouble due to abnormal happenings in the power system. These may be transients, but he must endeavour to make them micro-transients.

It is perhaps impossible to produce rotating electric machines free from harmonics, and similarly it must be expected that there will be some distortion of wave-form in power transformers owing to the employment of iron in the magnetic circuit, but if those responsible are made aware of the significance of these features in connection with the interference problem, they will be kept within reasonable limits.

Discussion in London.

Mr. A. J. Stubbs opened the discussion by pointing out that the power engineer found it difficult to appreciate the magnitude of the effects produced—the whole thing was so small. Certain things could never have been conceived, and apparatus now in use could never have been evolved by the power engineer or the communication engineer, as such, alone. The true path of progress was loyal co-operation between the two, and a striking instance of what such co-operation could do was the case recorded in the paper of certain telegraph circuits between Newcastle-on-Tyne and Sweden which were rendered unworkable by reason of the existence of a second earth on the power system; the removal of this obviated the laying of a new £100,000 submarine cable. The "cross-over" system of telephone wire transposition was not American as the author seemed to imply. The method was thoroughly considered in this country before it was used in the U.S.A., but the conditions were not favourable to its adoption.

Prof. E. W. Marchant explained that the subject would assume increasing importance as time went on and railway electrification increased. He was surprised at the figures mentioned in the paper with reference to the relative effects of 25- and 1,000-cycle currents; they were, he thought, too large, and the results obtained probably depended on the observer. He showed lantern slides illustrating his method of using resonant regulating shunts with a 3-phase machine to counteract harmonics, and also oscillograms of the current that flowed from the machine earth through the ground to the cable sheaths. In that connection he was no alarmist; they could be got rid of completely and easily—it was simply a question of which method was the cheapest. The prevention of interference with earthed circuits would be very difficult, and the use of metallic circuits only was the best proposition. The effects of harmonics could be eliminated and the production of an almost pure sine wave was only a question of cost.

Mr. E. Parry exhibited and explained curves of electrostatic and electromagnetic induction between power and communication lines, emphasising the magnitude and the effects. In cases where the calculated and observed figures differed, the discrepancy was thought to be due to the telephone line insulators being incapable of withstanding a high electrostatic charge from the neighbouring power line and so allowing it to drain to earth.

Mr. W. J. Thorrowgood pointed out that certain railway communication circuits that had been interfered with had been returned to normal working by the insertion of more resistance in, and raising the working voltage of, the circuit. Between Waterloo and Shepperton, for instance, it needed the insertion of 900 ohms to reduce interference and make telegraphy possible. Resistance had to be inserted in a short line between Waterloo and London Bridge, but when the circuit was extended it required no additional resistance. It should be understood that there were two kinds of interference; that which took place on long lines and that occurring on short circuits. For short lines (say, three-quarters of a mile long) especially near tramways, they had to provide a metallic circuit, and even power stations seriously interfered with short lines. Measurements he had had made showed that a difference of potential existed between two spots on the earth (for example, between Waterloo and Portsmouth or between London and Exeter) of as much as from 7 to 28 volts, and the difference varied continuously throughout the day and night. His opinion was that telegraph engineers should consider the problem and adjust their apparatus accordingly, instead of power engineers being required to provide the remedy. There was no great necessity to remove telegraph wires from power lines. On his railway system many circuits had not been modified in any way and they worked perfectly after the railway had been electrified.

Mr. R. A. Mack pointed out that the paper only dealt with open wire lines, but underground cable communication circuits were increasing and they could not be regarded as eliminating electrostatic interference. There were many examples in Europe, *e.g.*, in Switzerland and Sweden, which proved that single-phase traction systems provided no trouble. He suspected that Continental power machine makers were ahead of British designers from the point of view of machine interference with communication circuits.

Mr. G. V. Twiss discussed the various methods of power transmission and favoured the 3-phase system. Earthing had so many advantages that provision should be made for it and means devised for countering its defects. They must get used to high-voltage transmission and such lines could not be built unless they were earthed. Why did the Post Office authorities always "drop" on earthing and not on other things, such as harmonics? It was a sort of umbrella under which the Postmaster-General could seek shelter. Earthing was a means of providing for the safety of the public, but the responsibility for the protection of lines should not be laid upon electricity undertakers. Why did the requirements of the Electricity Commissioners and the Post Office differ? All such things were causes of friction and should receive attention. Development of the electrical industry was vital and went to the root of national welfare. It must, therefore, take place on the broadest lines and engineering public opinion should be broadened in order to enable them to view things in a different light from what they had done in the past.

Mr. S. C. Bartholomew, in his brief reply, said that with

regard to co-operation the Post Office had nothing to charge itself with; it had always been ready to help as had also power engineers. It was astonishing how serious machine noises could be and how far they would go. Telephone earths were used for signalling purposes, not for speech, and to eliminate them would lead to the slowing down of the working of the lines and would also involve much expense.

New Salvage Works at Birmingham.

On April 9th the Lord Mayor of Birmingham (Alderman T. O. Williams) inaugurated the new salvage works and destructor, which have been erected at Witton, Birmingham, by the Corporation Salvage Committee at a cost of £99,000. The plant will deal with the refuse of a population of 150,000 (30,000 houses) in the district of Erdington and parts of Handsworth and Lozells. An average of 150 tons will be dealt with each day.

The superintendent of the department is Mr. Jas. Jackson, who is responsible for several improvements in the equipment, and Mr. G. Watson is the consulting engineer. The plant is electrically driven.

The steam-driven generating plant for the electric vehicle charging equipment, and the lighting of the depôt, obtains the necessary power from the burning of the house refuse. All the electric motors were manufactured by Messrs. Crompton and Co., Ltd.; they are of the pipe-ventilated shunt wound, inter-pole type, and run at 650 r.p.m. V.i.r. cables are used throughout, with the exception of wiring across the yard to the clinker plant, which is C.T.S. cable. All starters are of the slow-motion type, fitted with no-volt release only, and rated for eight thirty-second starts per hour.

The generating plant comprises two high-speed condensing engines, coupled direct to d.c. compound-wound generators, made by the Electric Construction Co., Ltd., each of 100 kW capacity.

The engines are of Messrs. Belliss & Morcom's two-crank compound type, fitted with forced lubrication, with a separate valve line to each cylinder and automatic expansion gear to the high-pressure valve, enabling the engines to deal economically with overloads, or to maintain a steady load with variations in steam pressure. Each engine, running at a speed of 525 r.p.m., develops a normal continuous output of 145 b.h.p., with a steam pressure of 100 lb. per sq. inch, when exhausting into a surface condenser, which is common to the two engines. The sets are capable of withstanding an overload of 25 per cent. for two hours.

The condensing plant pumps are driven by an auxiliary engine of the same design as the main engines, and are thus independent of the electricity supply. The air pump is of the "Edwards" type, driven through enclosed gearing from one end of the auxiliary engine, the centrifugal circulating pump being direct-coupled at the other end. The condenser has a cooling surface area of 510 sq. ft., and is designed to maintain a 26-in. vacuum with both engines exhausting into it. The condensing plant is capable of dealing with 8,400 lb. of exhaust steam per hour. An oil separator is provided, together with all necessary valves, steam and water pipes.

The 230-V supply for lighting purposes is obtained by means of a three-wire balancer set, which consists of two shunt wound machines, each rated for 10 amperes and 220 volts. These machines are mounted on a cast-iron bedplate, and are connected by means of a flexible coupling.

A five-wire balancer set has been installed for charging the batteries of the electric vehicles. Eighteen battery-charging panels are installed. The generating plant, balancer sets, and charging equipment have been installed by the United Electrical Co. (Birmingham), Ltd., and the electric lighting has been carried out by Mr. S. Dodd, Harborne. The whole building is wired with C.T.S. cable by Callender's Cable & Construction Co., Ltd., and is equipped with Edison-Swan fittings.

The magnetic separators which are employed in the process of sorting, which all refuse has to undergo, were supplied by the Rapid Magnetting Machine Co., Ltd. Each of the Heenan & Froude rotary screens is fitted with an electro-magnetic separator, and the clinker plant has been fitted with a rotary drum-type separator of the totally-enclosed dustproof pattern. At the delivery end of each screen a cylindrical brass or non-magnetic extension piece is riveted to the dead plate of the screen. This revolves inside a fixed electromagnet, and fitted to the inner diameter and parallel to the imaginary axis are non-magnetic slats. The material in the immediate vicinity of the screen separator is influenced by a strong impinging field produced by the electro-magnets; the iron being attracted against the inside of the extension is carried round and upwards to a point where, by means of adjustable throw-off fingers, it is brought to the end of the magnetic field influence and dropped into a chute. The magnet windings and separator unit complete is stationary, and not actually in contact with the screen; consequently there are no wearing parts, and the windings, &c., are not under any mechanical or electrical stresses. The current is supplied directly to the magnets without the use of any current-collector gear. The design of the magnetic circuit is such that should any coil burn out it can be replaced without dismantling the rest. Facilities are provided for rapid inspection.

The Electrical and Engineering Exhibits at Wembley.

Preliminary Notices.

(*Concluded from p.* 632.)

Messrs. Mann, Egerton & Co., Ltd. (Norwich), are exhibiting grinding equipment, garage pressure cleansing tanks, air compressors, presses, engine stands, petrol air gas plant, &c.

The M.L. Magneto Syndicate, Ltd. (Coventry), is showing magnetos, combined lighting and ignition sets, an air-driven miner's electric lamp, high-pressure generators, rotary transformers, radio valves, &c.

Cantie Switch, Ltd. (Nottingham), is displaying quick make-and-break switches, fuses, and other switchgear.

The Vono Co. (Dudley Port) is exhibiting patent vices, anvils, &c.

Messrs. James Gordon & Co., Ltd., are exhibiting "Copes" automatic boiler-feed regulators, CO and CO_2 recorders, superheaters, and other boiler-house equipment, as well as hydro-electric plant—turbines, oil-pressure governors, &c.

Filmit, Ltd., is arranging the display of technical and industrial films.

Seal Co. (London), Ltd., exhibits its dry and inert cells, signalling lamps, and an electrolytic process for cleaning metals.

The Parsons Marine Steam Turbine Co., Ltd. (Wallsend), has an exhibit consisting of a typical double-reduction geared equipment with high and low-pressure turbines, gearing, blading, geared oil engines, &c.

The Acme Production Co., Ltd. (Birmingham), is showing radio apparatus, the "Texilscope," for the examination of precious stones and textiles, and automatic flashers.

The Turbine Furnace Co., Ltd., exhibits the application of its furnace to boilers of various types.

Messrs. Bramford, Ltd. (Birmingham), have a collection of weldless steel tube products, including tramway poles, expansion bends, joints, and pit props.

Messrs. G. D. Peters & Co., Ltd., exhibit air brakes for electric trains and trams, vacuum brakes, railway signalling apparatus, arc welding apparatus, gears, &c.

The Walford Art Co.'s exhibit comprises silk shades, oak standards, bowl fittings, "Erinoid" products, and other lighting accessories.

Metallisation, Ltd., demonstrates its metal-coating process for the prevention of corrosion, &c.

Messrs. Brolt, Ltd. (Oldbury), exhibit car-lighting dynamos, a dynamotor for lighting and starting, electric starters, switches, cut-outs, and other accessories.

Messrs. A. J. Stevens & Co. (1914), Ltd. (Wolverhampton), have arranged a display of radio apparatus, including receiving sets, variable condensers, power amplifiers, &c.

Victory Valves, Ltd. (Stockport), shows valves and boiler mountings with wrought steel bodies, and valves in bronze, cast iron, and other metals.

Erinoid, Ltd., is showing its insulating material in sheet and rod form, as well as switches, pushes, knobs, &c.

The Haslam Foundry & Engineering Co., Ltd., exhibits high-speed CO_2 compressors, ammonia compressors, and other refrigerating equipment. The company supplied the plant for the large refrigerated cabinets in the New Zealand section.

Fastfit, Ltd., shows examples of its "Fastnut" nuts and washers, and a patent ratchet spanner.

Messrs. G. & J. Weir, Ltd. (Glasgow), have as their principal exhibit Morel metal products. Other exhibits are feed-water heaters and de-aerators, boiler-feed pumps, oil pumps, air compressors, corrosion detectors, &c.

Messrs. Drysdale & Co., Ltd. (Glasgow), are showing pumps of various types.

Darimont Electric Batteries, Ltd., is displaying its batteries and their application to signalling, radio and wired telegraphy, small lighting installations, &c.

Chadburn's Ship Telegraph Co., Ltd. (Bootle) has a number of telegraph installations for ships, power stations, &c.; speed indicators, stoking indicators, de Laval oil purifiers, &c.

The Horstmann Gear Co., Ltd. (Bath) exhibits a number of examples of its "Newbridge" time switches.

Messrs. John Booth & Sons (Bolton) exhibit a large framed sign illustrating their works, as well as photographs of manufactures.

Selling Electric Power.

THE above was the subject of a paper read by Mr. W. C. Y. Anderson, of the Birmingham Electric Supply Department, at the final salesmanship conference in London of the E.D.A., which was held on April 11th. Mr. J. W. Beauchamp (director of the E.D.A.) presided, Mr. B. Longbottom (chairman of the B.E.A.M.A.), who had promised to take the chair, being unable to attend.

Mr. ANDERSON gave in his paper some very interesting figures from workshops in Birmingham showing the advantages which had been obtained by manufacturers as the result of changing over from steam, gas, or other forms of power to electricity, and these figures should prove valuable to those engaged in selling power. The speaker said that never before had there been any one commodity which had entered more intimately into the needs of civilised society. A great development was going on all over the country, and manufacturers must give salesmen adequate backing, and anticipate, where possible, the needs of the future. The salesman should collect information about the various industries in his district, and organise his department so as to let manufacturers know how their requirements could be met by his "goods." He must have statistics and data to show that what he had to supply was the best suited to that purpose, and must keep in close touch with his customer until that customer was completely satisfied. The sales engineer must give his consumer the best possible service and attention.

Dealing with the progress made at Birmingham, Mr. Anderson said he had five outdoor assistants, each of whom was given a district, in which he was responsible for the lighting, power, heating, and cooking developments. He was responsible for advising consumers on installations. Circular letters were sent into roads where there were no mains, asking whether, if it was decided to extend, the residents would consider the uses of electricity, and suggesting appointments to discuss the matter. The sales engineer also canvassed the road, and the mains were extended if it were considered a proposition that would bring in a fair revenue for the first year, bearing in mind that the next two years would always bring additional consumers. He also kept a sharp look-out for new houses, works, kinemas, or other buildings under construction in his district. The sales engineer must be detached from manufacturers, so that he could give impartial recommendations as to plant and appliances.

For the education of the public, there were large showrooms in the centre of the city, where the technical staff demonstrated all makes of apparatus, and it was rarely that a sale was not effected. Everyone had a firm idea that in a Corporation showroom he would get an unbiased opinion, and would receive the best advice. In order that manufacturers might have practical demonstrations of the value of the electric drive, the Department hired out electric motors. This scheme was very popular, and there were 1,600 motors, totalling 10,000 h.p., now out on hire. The Electricity Department also had stands at exhibitions, and advertised on accounts, in the local Press, at each tram terminus, in tram guides, and placards on the hoardings in the city.

Mr. Anderson said he had great faith in getting permission for a prospective power consumer to visit other works to see electric motors in operation, and to have a frank talk with the manager. Concrete facts regarding changes over to electric power which had come under his personal notice in various trades were then given. The speaker had always found that the most reliable way of estimating the consumption of electricity in any workshop or factory was to take each trade separately and find out the average costs in a number of typical cases.

A number of lantern slides were then shown of electrical installations in various workshops, and figures of costs relating to installations on the Birmingham mains. A number of typical cases showing the cost of driving by electricity as compared with steam, gas, and suction-gas plant were presented.

Mr. Anderson said that the attention of possible purchasers should be drawn to the many advantages of electricity other than in the cost of power. For example, the application of gas engines to rolling mills had the following drawbacks:—(*a*) cyclic irregularity of crank effort; (*b*) increased weight of flywheel required; (*c*) 25 per cent. of full load gas consumption when running light; (*d*) higher rating required. Maximum required probably 300 h.p., whereas, except for momentary load, only 50 h.p. was necessary; and (*e*) increased space required. His personal experience was that when the owner of a mill with a gas engine which had had its day decided upon another form of driving, he rarely considered the idea of installing a new gas engine. The question nearly always was whether he should take electricity from the Corporation mains, or generate his own. Gas *versus* electricity was no longer a serious consideration to any manufacturer who had had gas engine experience. They had proved repeatedly in Birmingham that with electricity at present rates it was cheaper than oil even on steady loads, where an oil engine drive should be at its best.

With regard to cooking, the following example of a four-months' test of joint cooking in the mess rooms of the Birmingham Electricity Department was given. Approximately 40 meals were cooked per day on an average, and in addition 10 dinners were warmed up. Two ovens were used, a Jackson No. 21, with a capacity of 6.3 kW, and a 6-kW Haden cooker. During the trial period 78 joints were cooked, the weight before cooking being 992 lb., and after cooking 882 lb., which showed a shrinkage loss of only 11.1 per cent. The current consumption was 748 kWh, which, at 1½d. per kWh, was equal to £3 17s. 11d. The average consumption per week was 41.6 kWh and cost of current 4s. 4d. That was a convincing practical demonstration of the efficiency and economy of electric cooking.

Opening the subsequent discussion, Mr. BEAUCHAMP said that in Birmingham they were connecting 80 new consumers per week, which showed the immense vitality of electricity supply. It was up to the industry to go to manufacturers and suggest additional ways in which they could use electricity; it was no good waiting for them to come and suggest them to the industry. In America the electrical manufacturers employed experts and spent large sums of money in analysing each trade, to find out how much more electricity could be used for lighting, heating or power, and then passed the information round to those in the country as a sort of guide to the canvasser.

MR. W. E. ROGERS (West Ham) did not agree with Mr. Anderson in dividing his area into districts. The power problem ought to be allocated to one man; each branch was a specialised job if the best results were to be obtained.

CAPT. H. HOOPER (manager, Messrs. Veritys, Ltd.), referred to a paragraph in the ELECTRICAL REVIEW which asked why America had an approximate consumption of 500 kWh per head per annum, whereas this country only had 100, and gave the equally pertinent answer that the American supply authorities went to the people and did not wait for the people to come to them. Manufacturers in this country would be glad if the supply undertakings would take the energy to the customers and not leave it to manufacturers to persuade customers to go to the supply authorities. Electricity in this country, generally, was excessively dear, and this did not encourage its general use. If we could get a standardised supply the sale of electricity and apparatus would be simplified. The figures given by Mr. Anderson would be a great help to the sales engineer. There had never been more destructive criticism of the industry than that which had arisen through power engineers giving wrong figures to a consumer as to what his bill would be. It was much better to put the figure on the high than the low side.

MR. F. T. HALL (North Metropolitan Electric Power Supply Co.), said that the gas engine had ceased to be a very formidable competitor, but the heavy oil engine was very suitable for fairly large applications, and salesmen needed to go into the matter carefully. The figures as to American consumption were discouraging if harped upon overmuch; conditions there were utterly different from conditions here; in many towns there was no gas supply. He also deprecated attacks by manufacturers on the supply authorities, because it did not help. There were many things which the supply people might criticise manufacturers about.

MR. H. W. ROBERTS (G.E.C.) agreed with Mr. Hall as to electricity supply in America. The Americans talked about 500 kWh per head, but they disfigured their streets with a tremendous amount of unnecessary lighting, which accounted for a very large consumption per head.

MR. W. A. GILLOTT mentioned the case of a steam-driven printing works in which by the electrification of one section the superiority of the electric drive over the wasteful steam methods was demonstrated to the proprietors.

MR. ROBERTSON said that he had seen that in Birmingham they had connected 600 new consumers in one month, and asked Mr. Anderson how it was done.

MR. E. J. RILEY said that Birmingham Corporation had a Gas Department, and, in connection with housing schemes, there might be mutual agreement between the two departments. Also, in connection with persuading power consumers to turn over to electric drive, the Electricity Department must have access to a certain extent to figures from the Gas Department.

MR. ANDERSON, in reply, said that the number of consumers connected during the year ended last March was 4,138. He did not agree with Mr. Rogers that each branch of electricity supply should be dealt with by one man. He never engaged a man who was not an engineer, and if a sales engineer was up against any trouble, he came to him (Mr. Anderson) and he went down personally to see that everything was all right. They had consumers with over 5,000 h.p. installed. There were 229 extremely large consumers, and he had never lost one, except where they had removed from the district. In reply to Mr. Hooper, he said that the Department canvassed very thoroughly. As to the number of consumers, in one month they had connected 627 new consumers and in another 652, and that was done by really hard work; that was the only way to build up the load. As the result of co-ordination between contractors, manufacturers, and the supply department they were getting on extremely well. They had no access to figures regarding gas consumption through the Gas Department, but generally obtained them from manufacturers themselves.

Exports and Imports of Electrical Goods and Machinery in March, 1924.

THE March returns of electrical export and import business show as regards the former a general falling-off in values, while the total of the latter shows a slight increase.

The exports, which in February were valued at £1,253,176, fell in value to £1,078,541 in March, the decrease in the total being mainly attributable to the falling-off in telegraph and telephone exports, electrical machinery, and cables. On the other hand, the imports which in February reached a total value of £289,434, in March amounted to £318,705, an increase of £29,271, due to the greater values particularly of electrical machinery and telegraph and telephone material imports. The re-exports for the month were valued at £10,909, as compared with £17,624 in February.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Mar., 1924.	Inc. or dec. as compared with Feb., 1924.	Inc. or dec. as compared with Mar., 1923.	Electrical imports for Mar., 1924.	Inc. or dec. as compared with Feb., 1924.	Inc. or dec. as compared with Mar., 1923.	Electrical re-exports for Mar., 1924.	Inc. or dec. as compared with Feb., 1924.	Inc. or dec. as compared with Mar., 1923.
Electrical goods and apparatus (unenumerated)	£137,862	+ £1,105	+ £26,092	£73,495	— £4,133	+ £21,127	£3,754	— £828	+ £868
Insulated wires and cables ...	200,114	— 31,929	+ 24,540	28,599	— 4,394	+ 11,808	56	— 19	— 2
Glow lamps	19,098	— 3,326	— 1,697	8,860	+ 2,032	— 4,783	646	+ 219	— 214
Arc lamps and parts	1,804	+ 999	+ 699	788	— 503	— 809	9	— 48	+ 9
Batteries and accumulators ...	56,047	+ 17,376	+ 7,113	18,332	— 9,812	+ 6,741	32	— 544	+ 32
Meters and instruments ...	31,593	+ 2,540	+ 10,269	13,731	+ 2,573	+ 6,269	853	— 1,205	+ 723
Carbons	3,253	— 1,448	— 3,930	9,674	— 4,289	+ 7,306	135	+ 114	+ 70
Electrical Machinery—									
Electrical machinery (unenumerated)	135,162	— 59,254	+ 1,223	99,024	+ 41,573	+ 16,987	3,548	— 3,072	— 7,362
Railway and tramway motors	62,688	+ 32,156	+ 41,025	—	—	—	—	—	—
Other motors and generators ...	191,564	+ 7,227	+ 50,642	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	8,689	— 3,563	+ 4,755	44	— 9	+ 4	76	+ 76	+ 40
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	48,927	— 42,048	— 49,543	11,486	+ 6,858	+ 6,809	—	+ 280	— 4
Submarine telegraph and telephone cable	16,445	— 37,976	— 30,836	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	165,295	— 56,494	+ 48,738	54,672	— 625	+ 21,593	1,800	— 1,128	+ 379
Totals	£1,078,541	— £174,635	+ £119,084	£318,705	+ £29,271	+ £93,052	£10,909	— £6,715	— £5,461
Increase or decrease for the three months ended March, 1924 ...		Exports. + £505,338			Imports. + £149,111			Re-exports. + 8,542	

The New Italy.

Signor Mussolini's Reforms.

A VERY promising outlook is indicated in a report on the economic situation in Italy which has recently been issued by the Department of Overseas Trade.

It has been written by His Majesty's Commercial Secretaries, Mr. J. H. Henderson and Mr. H. C. A. Carpenter, and its perusal will give a clear idea of the many reforms undertaken by Signor Mussolini's government. The reforms have covered civil services, public works, agriculture, and communications, as well as many branches of commerce and finance. There will be general agreement with the statement that it would be difficult to find a historical parallel for such a record of achievement.

The great handicap to British trade with Italy during the past few years has been the low sterling value of the lira. More recently Italian currency has appreciated and become more stable. As the plans of the Fascisti Government materialise and bear fruit, a gradual improvement in Italian State finances is already beginning and is expected to continue. This should bring a further rise in the value of the lira, and thus help the sale of British goods in Italy.

In spite of the work carried out in developing the hydro-electric resources of the country, very large quantities of British coal are still imported, the total during the first six months of last year being 4,770,000 metric tons, as compared with 4,640,000 tons during the corresponding period of the previous year. It is reported that German reparation coal has not affected industrial needs to any appreciable extent, and American coal is practically a negligible factor in the market. It is anticipated that the advance of Italy's various industries will result in the demand for imported coal being maintained, in spite of the exploitation of the country's water power.

Water Power.

During the period from November, 1922, to November, 1923, 134 concessions for water power schemes were granted capable of producing 667,000 h.p. Over 370 other schemes to produce more than one million h.p. were being examined by the Ministry.

Detailed statistics on hydro-electric progress in 1923 have not yet been prepared, but it may be stated generally that continued progress has been made in the construction of water works and power stations. The Tirso reservoir has been completed, and work has been commenced on the Sila scheme which is expected to do much to develop the mineral, industrial, and agricultural resources of Calabria.

As Signor Mussolini's régime has progressed and conditions generally have become settled, more satisfaction has evidently prevailed amongst the working classes. The record of working days lost through strikes or lock-outs has recently been very low. The figures are as follows:—

Period—Nov. 1st to Oct. 31st.	No. of Strikes.	No. of Strikers.	Working Days Lost.
1922-23	156	52,604	246,975
1921-22	680	522,354	7,336,393
1920-21	1,223	709,940	8,210,811

Unemployment due to lack of work has similarly shown a consistent decrease. The number stood at 321,000 in November, 1922; it rose to a maximum of 392,000 on February 1st, 1923, and sank gradually to 179,000 on September 1st, 1923.

Electrical Trade and Industry.

Prices of British pumping plant are still said to be 40 or 50 per cent. too high to compete with local manufacturers, who produce everything except the largest pumps.

The Commercial Secretaries' comments regarding the electrical trade reveal a depressing situation. It is, of course, well known that Italy is rapidly improving her output of electrical apparatus of all kinds. She cannot, however, afford to

dispense with a number of special types which are not yet made in the country, and her needs are principally supplied by America, Germany and Switzerland. With the exception of motor accessories, it is becoming increasingly difficult to sell British electrical material. Telephonic and telegraphic material is supplied by the United States and Germany, and electric motors, which used to be imported from Great Britain, are generally made locally, often to run in conjunction with imported machinery. Electric glow lamps are nearly all imported, and practically every type is available. Holland has a good share of the trade. Such lamps are, however, beginning to be made in larger quantities in Italy.

According to the Commercial Secretaries' report, the situation of the Italian engineering industries was not satisfactory during the first part of 1923, owing to the lack of orders. The position of the shipbuilding yards and all concerns producing for the State and the public services in general was especially unsatisfactory.

A slight improvement was noticeable later, which was reflected in the decrease of unemployment and the renewed activity of special foundries. The electrotechnical industry benefited from diminished German competition, particularly in heavy goods, but not to the same extent in lighter articles. The producers of hardware goods and domestic utensils are feeling the effect of small consumption, and in enamel goods the competition of Czecho-Slovakia is perceptible. Certain specialised articles, such as lifts, continue to be exported on a small scale, but on the whole the export trade does not present a promising outlook.

Importing Methods.

The report contains an interesting section on the difficulties that stand in the way of an expansion of British trade and the methods by which they may be to some extent overcome. Emphasis is laid on the fact that Italy is at present a buyer's market, and the exporter offering the easiest conditions of payment will frequently get business, even from a competitor who is in a position to offer more favourable prices. It is said that criticism is still frequently heard of the harshness of terms offered from the United Kingdom. Another criticism frequently made is with regard to the small number of British commercial travellers who visit Italy, and a plan is described by which foreign representatives work outlying districts, travelling economically and tapping business at its source without a long chain of intermediaries.

The expedient of selling in lire or of consenting to a maximum rate of exchange is a popular one with French firms. German firms as a rule favour the plan of leaving considerable stocks in the hands of an agent in Italy who has authority to sell as he finds it possible in lire, converting into other currency as individual sales are effected. The latter policy deserves consideration, for there is no doubt that the exporter holding stocks in Italy is in a position to benefit by his greater facilities for quick delivery. With regard to exchange, however, the important point, in order to attract custom, is to relieve the Italian purchaser of the anxiety of risks due to fluctuation, either by submitting firm offers for immediate delivery in his own currency, or by placing a maximum on his liability.

It is reported that some German and Czecho-Slovakian firms, who are doing a considerable amount of business in Italy, have adopted the system of allowing their agent, in addition to commission and advertising allowance, a salary which by agreement will be diminished or terminated when the turnover has reached an amount which guarantees an assured yearly income to the agent.

Railway Electrification.

The report states that the total mileage of electrified line at June 30th, 1923, had been extended to 436.2 miles, an increase for the year of 8.1 miles. By supplementing the Ronco-Turin electric service it has been possible to run the entire Genoa-Alessandria-Turin-Modane line exclusively with electric traction. Although the actual new mileage completed in the financial year appears small, it is pointed out that the revised programme for the future electrification of the Italian railway system and the plans for hydro-electric plant are undergoing a close examination by the competent mechanical departments, and it is contemplated that the revision will lead to speedier and more satisfactory results than in the past.

The following statistics relating to the year 1921-22 as to the cost of electric traction compared with steam traction, are reproduced in the Commercial Secretaries' report as showing the economy effected in Italy by the use of the former:—

	Steam. Kilometres.	Electric. Kilometres.
(1) Ordinary gauge lines worked...	14,951	689
Ton-kilometres hauled ...	36,120.9	2,623.8
(2) Expenses—	Million lire.	Million lire.
Locomotive staff	337.87	15.95
Fuel	692.39	—
Electrical energy	—	6.80
Supply and pumping of water	4.24	—
Upkeep of locomotives ...	307.58	13.27
Working and upkeep of fixed plant	—	12.74
Total	1,342.08	48.76

	Steam. Centesimi.	Electric. Centesimi.
(3) Expenses per ton-kilometre hauled—		
Locomotive staff	0.930	0.609
Fuel	1.920	—
Electric energy	—	0.259
Supply and pumping of water	0.010	—
Upkeep of locomotives ...	0.850	0.506
Working and upkeep of fixed plant	—	0.486
Total	3.710	1.860

The haulage by steam per ton-kilometre therefore exceeds electric haulage by 1.85 centesimi, in other words by 50 per cent.

Including capital charges (interest and sinking fund) the cost per ton-kilometre hauled is:

	Steam. Centesimi.	Electric. Centesimi.
Working expenses	3.710	1.860
Capital charges	2.365	2.464
Total	6.075	4.324

It appears therefore that in 1921-22 electric traction cost 28 per cent. less than steam traction.

Signor Mussolini's schemes for transferring certain public services—including telegraphs and telephones—to private enterprise are well known. The Commercial Secretaries' report gives certain details, which need not be reproduced here. It may be mentioned that the programme of improvements which the concessionnaires would be called upon to carry out during the next ten years comprises the installation of telephones in the 5,000 communes which at present have no telephone service and the erection of additional exchanges capable of dealing with at least 130,000 new subscribers.

Electricity Supply in Canada.—The Dominion Bureau of Statistics has issued a preliminary report on the central electric station industry in Canada during 1922. From this statement it appears that the number of central electric stations in the Dominion has increased by 14 per cent. during the past five years. The capital employed shows an increase of $166,126,000, or 41 per cent., and revenues have grown by $28,780,000, or 54 per cent. The largest addition during this period was contributed by the Ontario Hydro-Electric Power Commission; this began commercial operation in January, 1922, and increased the capitalisation of the industry by over $65,000,000, whilst adding 165,000 h.p. to the total installation of the Dominion. During 1922 only three turbines were operating at the new station; the fourth was installed in December, 1922; the fifth early in 1923; and the sixth in December, 1923. Other large additions during 1922 were 10,000 h.p. at Ranney Falls on the Trent River, 2,400 h.p. at Sault Ste. Marie, Ont., 43,000 h.p. at Shawinigan Falls, and 22,000 h.p. at Grand Mere on the St. Maurice River, 13,000 h.p. at Stave Falls, B.C., 7,200 h.p. on the Bull River, Fernie, B.C., 6,700-h.p. steam turbine at Edmonton, 1,000-h.p. steam turbine at Drumheller, Alta., 6,900 h.p. on the Winnipeg River at Point du Bois. The Manitoba Power Co. also completed an installation of 28,000 h.p. of a 168,000-h.p. project on December 28th, 1922, which is not included in these data. A water turbine of 2,250 h.p. at Grand Falls was an addition in New Brunswick, and in Nova Scotia 10,800 h.p. was installed at St. Margaret's Bay by the Nova Scotia Power Commission. Two wheels aggregating 40,000 h.p. of the Ontario Power Co. at Niagara Falls were damaged and were not replaced, reducing the power of 1922 accordingly. The net increase in installed power was 280,541 h.p. in main plants and 17,704 h.p. in auxiliary plants. Steam engines showed a decrease from 1921, but water wheels and turbines showed an increase of 285,932 h.p., being by far the greatest increase since the statistics were first compiled in 1917. These data refer only to the central electric station industry for 1922, and not to water-power development, although approximately three quarters of all water power developed in the Dominion is employed in this industry.

The total output of central electric stations during the year was 6,740,750,000 kWh, and the average revenues to the stations generating this electric energy was .715 cent per kWh. Stations using water power showed much the lowest revenue per kWh. In Ontario the average was .538 cent; in Quebec, .640 cent; and in British Columbia, .749 cent. This is the net revenue, *i.e.*, the gross receipts of generating stations, less the cost of power purchased, and includes all line and transformer losses, &c. The price to the consumer is much higher on account of these losses, cost of transmission, distribution, &c.

The Building Exhibition.

As was briefly stated in our last issue, this exhibition was opened by the Minister of Health (Mr. J. H. Wheatley), on April 11th; it closes on the 26th.

Although there are between 250 and 300 exhibitors, only a few of the displays are of strictly electrical interest. We deal with these below.

The Sturtevant Engineering Co., Ltd.

This company exhibits a selection of its suction cleaning equipment. One set shown is the No. 8 type plant (fig. 1), consisting of a turbo-exhauster driven by a direct-coupled 5-h.p. motor, the two machines being mounted on a cast-iron bedplate; a dust separator; a line of suction piping, including special bends, junctions, and hose-connecting points; lengths of flexible hose; and a complete equipment of cleaning tools.

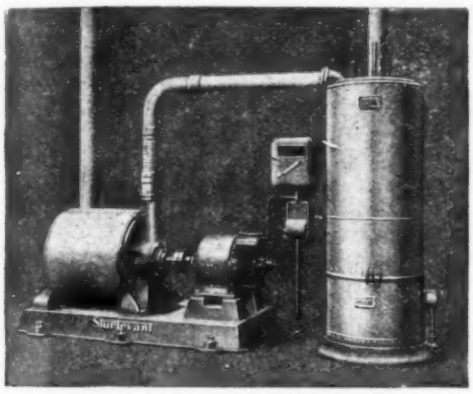


Fig. 1.—A Sturtevant Turbine Cleaning Set.

The apparatus is fitted with "Igranic" automatic push-button equipment for remote control. The cleaning tools are strongly constructed in polished aluminium. The No. 5 portable machine is also shown. This comprises a filter and a turbo-exhauster driven by a .5-h.p. motor combined in one unit and mounted on wheels. Being constructed largely of aluminium, this machine is light enough to be moved easily from place to place; it is, however, of very robust construction. Its low power consumption makes it possible for the machine to be connected to a lighting circuit. These two machines are demonstrated on the stand. Other exhibits are a No. 10 (fixed type) exhauster, and a small portable blowing set equipped with a flexible hose and nozzle. The latter set is suitable for cleaning out the windings of electrical machines.

Messrs. Waygood-Otis, Ltd.

The principal exhibit upon the stand of this company is a special high-speed gearless-traction lift equipment. This gear, which is illustrated in fig. 2, has its sheave directly connected through a flexible coupling to a slow-speed (60 r.p.m.) 30 h.p. motor. A self-levelling arrangement is fitted by means of which, if a lift is stopped a little above or below the landing level, the whole of the winding gear, including the brakes, is turned until the self-levelling motor is cut out by the limit switch at the landing. A contactor control equipment for this machine is exhibited, the control being actuated by push buttons. Another exhibit is a model escalator of the pattern recently supplied to the London "Underground" Companies. In this type of escalator the side-stepping on and off the moving platform is done away with, a direct landing being given at top and bottom. The escalator is built in two sizes, one 2 ft. wide with a capacity of 4,000 passengers per hour, travelling at 90 ft. per minute, and the other with twice the width and, consequently, double carrying capacity. These machines are arranged for quick reverse, and are fitted with emergency brakes, speed governors, and other safety devices.

Mr. H. C. Slingsby.

In addition to a large number of ladders and similar equipment, a small industrial electric locomotive is to be seen on this stand. This has an overall length of 6 ft., and is constructed for 18 in. or 36 in. gauges. It is gear-driven on all four wheels and similarly braked. It can be equipped with either a lead-acid battery or one of the Edison type, and the weight of the battery is equally distributed over the wheels. A drum-type controller is fitted. The normal draw-bar pull is 350 lb., but it can reach a maximum of 1,400 lb. The firm also shows industrial electric trucks of many patterns, including the lifting type.

The Hoisting Appliance Co.

Among many examples of lifting equipment this firm shows a 1-ton electric lifting block fitted with a trolley arrangement for mounting on the flanges of a girder. This appliance has a lift of 25 ft., and hoists at a speed of 20 ft. per minute. An electric passenger-lift gear of the ordinary pattern is shown in operation. A simple form of service lift is exhibited; this is a push-button controlled equipment which requires only a .5-h.p. motor to operate it.

Messrs. A. A. Byrd & Co.

This firm shows a complete range of electrically-driven bench machines for woodworking. This comprises a circular saw with a special spring-controlled guard, a band saw, and a planing machine. In each of these machines the motor (¼ or ½ h.p.), is arranged to give a drive of the maximum efficiency; it is mounted on ball bearings and the cutting gear is connected directly to the shaft. In the case of the circular saw the whole of the rotating gear is mounted on a tilting table which can be set at an angle to the cutting table for producing accurate angle work. The equipment would be most suitable for a small pattern shop.

Other Exhibitors.

The Rawlplug Co., Ltd., has its usual display of "Rawlplugs" and their applications as well as numerous aluminium household fittings. The International Electrical Co. and the British Home & Office Telephone Co. show intercommunicating telephone equipment. Alklum Electrics, Ltd., exhibits "Alklum" nickel-iron accumulators. Carbon Company has two or three electric fires among its grate exhibits. The Flexible Drive & Tool Co. shows its motor-driven flexible-shaft grinding and drilling equipment. Messrs. Drummond Bros. exhibit a 1-kW "Willing-Worker" lighting set and components. The Key Engineering Co., Ltd., has samples of its fibre conduit suitable for underground cables. Messrs. Butters Bros. & Co. display working models of an electric derrick crane and an overhead crane. Messrs. Worsnop & Co., Ltd., show electric lamps, and Messrs. I. & M. Steingold demonstrate floor-planing equipment, &c.

A number of firms show woodworking machinery, concrete mixers, stone-breakers, &c., belt-driven by electric motors.

Cable-making in Czecho-Slovakia. — A correspondent states that a combination, formed by the seven leading cable-manufacturing firms in Czecho-Slovakia, with a view to reducing production and so preventing the fall in prices, has been dissolved, owing to the recent starting of new cable companies. It is added that the position in the immediate future is now therefore likely to become worse, as the terms of the new commercial treaties favour imports by reductions in customs tariffs, thus leading to further over-supplies to the inland market.

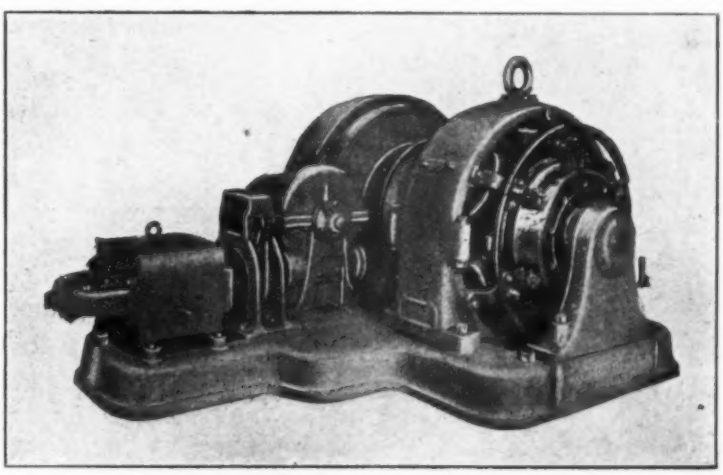


Fig. 2.—Gearless Traction Micro-Drive Lift Equipment.

A 135,000-Volt Outdoor Oil Circuit Breaker.

A New Ferguson Pailin Product.

An indication of the rapid development which has taken place in the British electrical manufacturing industry is afforded by the introduction by Messrs. Ferguson, Pailin, Limited, of a 600-amp., 135,000-volt, 3-phase automatic outdoor oil circuit breaker (Type " W "), to meet the demands of the company's Australian and Canadian branch factories, in whose territories these high pressures are in constant use. A three-phase breaker is shown in fig. 1, and it will be noticed that each pole is a self-contained floor-mounting unit interconnected by the driving mechanism, which is joined up to an electrical or manual operating device located on the floor adjacent to the last unit. The breaker has been designed for heavy power systems and has a rupturing capacity of 750,000 kVA. It incorporates a special form of arcing contact giving rapid acceleration and operating under a large head of oil; an all-steel enclosure capable of resisting high internal pressures, including a large expansion chamber and baffle vent for the arc gases, together with an oil and gas separator; and porcelain shrouded Bakelite condenser bushing terminals accommodating ring-type current transformers for automatic operation.

The terminal bushing is the most important item in any high-voltage apparatus, and very great care has been exercised in its design. A detail view is shown in fig. 2. It is built on the well-known condenser principle with alternate layers of tin foil and Bakelised paper wound concentrically. The bushing is so proportioned that approximately equal voltage stresses exist between successive layers, so that no portion of the insulating material bears an electrostatic stress exceeding the safe limit of the material. Furthermore, by the

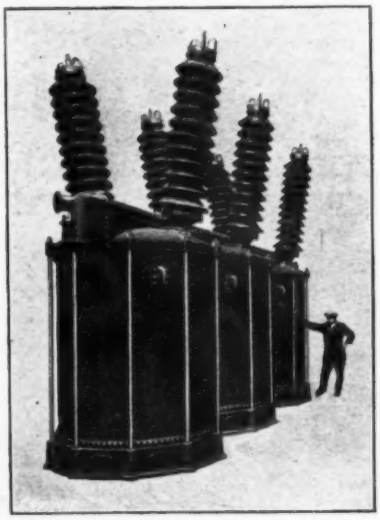


Fig. 1.—Ferguson Pailin 135,000-V, 3-phase Circuit-breaker.

stepping of the tin-foil layers a uniform voltage gradient is obtained along the axial length of the bushing. The upper end is protected by a series of porcelain petticoat insulators cemented together, the whole being weatherproof, and the space between the insulators and the condenser bushing is filled with plastic compound. Hard setting compound is avoided, to guard against cracks and condensation. The lower end of the bushing, which carries the switch contacts, is provided with a porcelain shield, which prevents the carbonised sediment usually present in the oil from settling on the condenser layers. The flange which is used for fixing the terminal bushing to the base casting is of non-magnetic material, to allow a ring current transformer to be slipped over and fixed to the under-side of the base casting. The complete bushing with stationary contacts can be withdrawn from the breaker by the two eyes provided, without in any way disturbing the bushing-type transformer and its connections or the moving contacts.

All the exposed surface of the bushing is at earth potential, consequently no corona or static discharge can take place in the air space above the oil; this is essential in order to prevent danger from the explosion of the gases which may collect there.

An interior view of the breaker is shown in fig. 3. The moving contact consists of a circular Bakelised contact bar with inverted V-shaped ends, which engage with the finger contacts. This is carried on two solid Bakelite rods which are provided with double flanges on each side to increase the leakage surface. The stationary contacts and the ends of the moving contact are enclosed in metal shields in order to reduce the electrostatic stress, which would otherwise be excessive on the sharp corners of the contacts.

The top-plate of the breaker is of cast-steel, and supports the terminal bushings and the operating mechanism so that all are aligned from surfaces on a single unit. It is provided

Fig. 2.—A Termina Bushing.

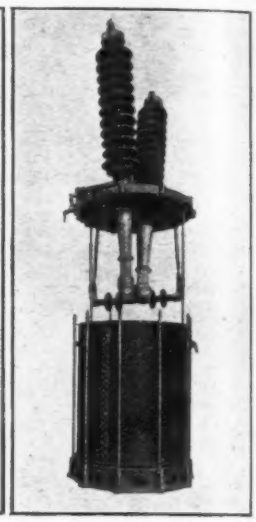


Fig. 3.—Interior of Circuit-breaker.

with a man-hole. The dome top forms an expansion chamber to cushion the pressure incident to the interruption of large currents. Suitable baffled vents are provided, incorporating an oil and gas separator, which prevents the possibility of oil throwing. The oil and gas displaced on current interruption impinge against the baffles, and the gas is allowed to escape to a vent pipe, which projects downwards, whilst the oil is trapped in a well closed by a valve so arranged that while there is pressure in the tank the oil is retained, but after the pressure has subsided the valve opens and allows the oil to return for further use.

The operating mechanism is accommodated below the top plate, and is self-contained for each single-phase unit. As it works through a rotating shaft, it does not displace oil and air when the breaker is opening, so there is no tendency for

Fig. 4.—Contacts Closed.

Fig. 5.—Arcing Contacts about to open.

Fig. 6.—Arcing Contacts released.

the breaker to be blown in again. The Bakelite rods carrying the moving contacts are provided with end fittings which slide on vertical rods guiding the contacts throughout their travel. Accelerating springs, which are adjustable, are attached to the top of each guide rod, and oil dash-pots are

provided for retardation at the end of the stroke. The moving contacts can be withdrawn through the manhole if repairs are necessary.

The greater travel and wider spacing of moving contacts on extra-high-pressure breakers necessitate the use of heavy moving parts. These are difficult to accelerate, and as a high rate of contact separation is imperative in order to reduce arc duration to a minimum, it has been necessary to embody a special form of quick-break attachment. The arcing contacts separate at a much higher velocity than the main contacts. This is accomplished by an ingenious arrangement whereby at the instant of interruption, one arcing contact travels upwards and the other downwards. In the opening operation the main contacts separate first and a latch holds the two arcing contacts together, the upper one being pulled down, thus compressing a spring-loaded telescope, until the moving contact has dropped approximately 8¼ inches. The latch is then released and the spring retrieves the upper arcing contacts. Fig. 4 shows the contacts closed, fig. 5 the arcing contacts about to separate, and fig. 6 the contacts just released and travelling apart at a very high speed. It will be seen that the arc actually takes place well removed from the main contacts, and a clear path is ensured for the upward movement of the gases. The magnetic effect of the current passing down one stationary contact across the moving member and back through the other stationary contact is such as to deflect the arc away from the contact and towards the side of the tank. Holes in the bottom of the corona shields on the moving contacts allow clean oil to be forced up to the arcing contacts on opening.

The tanks are cylindrical, 5 ft. 3 in. in diameter, with hemi-spherical bases, and are made of heavy boiler plate; they will withstand a pressure of 250 lb. per sq. inch, and are rigidly held between the heavy steel cradle and the top plate by means of ten 1¼-in. diameter steel bolts, the latter fitting close to the tank sides. The tanks are provided with insulating linings.

The incorporation of the F.P. patent supersensitive tripping device enables the primary tripping current to be cut down to less than half the usual value. This means that even on low-current circuits, overload protection may be provided by using bushing-type transformers operating on a.c. trip coils without the use of relays or auxiliary tripping supplies.

A typical breaker as described above has successfully withstood a pressure test of 300,000 volts (virtual) at 60 cycles for one minute applied between the terminals and earth, and the makers hold a certificate issued by the Manchester College of Technology verifying this. The weight of a three-phase breaker complete with oil and solenoid operating gear is approximately 22 tons, and the oil required is 2,400 gallons. The weight of one condenser bushing complete is nearly ½ ton. A single-phase unit of this type is being exhibited by Messrs. Ferguson, Pailin, Ltd., at the British Empire Exhibition.

Reviews.

The Inspection and Testing of Materials, Apparatus and Lines. By F. L. Henley, M.I.E.E. Pp. xi+355; figs. 151. London: Longmans, Green & Co. Price, 21s. net.

This book is the third of the series of manuals of telegraph and telephone engineering which are being published under the editorship of Sir William Slingo. The manufacture of telephone apparatus is an important and growing industry in this country and it is probably subjected to more rigorous inspection than any other engineering product. One of the objects of the present work is to widen the outlook of the men engaged in inspection and give some insight into the reasons underlying the requirements of the specifications to which the apparatus is manufactured. With this end in view, the first half of the book, except for a chapter on stress and strain, deals with the raw materials of the industry such as iron and steel, copper, wood, india-rubber, gutta-percha, and porcelain. The methods of manufacture are described, together with the approximate tests to prove that the desired quality is obtained and extracts from specifications are included to show what the Post Office demands from its suppliers. This portion of the work makes very interesting reading, and, although most of the information is obtainable elsewhere, adds considerably to the value of the book as a whole. Incidentally, the author gives numerous references to the publications from which fuller information on this portion of the subject can be obtained.

A chapter on dry cells gives particulars of the tests applied by the Post Office and useful information on the total outputs to be obtained from different sizes of cell. Users of these cells often desire to test the condition of an individual cell, but it appears that there is no reliable method of finding what output a cell will give without actually taking out the energy, by which means the cell is rendered useless. The only remedy is to purchase cells of a reliable make.

The methods of testing telephone transmitters and receivers are described in detail. On page 167 a subscriber's circuit using an electromagnetic receiver is described as the standard circuit for automatic working. We were under the impression that the tendency was towards standardising the induction coil circuit which is now almost universal for common battery telephones.

An interesting curve is given in this section showing the effect on transmission of speaking at a distance from the transmitter. It would surprise most users of the telephone to know that a distance of two inches between the mouth and the mouthpiece causes a loss equivalent to seventeen miles of standard cable. The author rightly lays considerable stress on the importance of good workmanship and finish. With apparatus of this nature, where a considerable proportion of the work, such as the windings of relays and coils, must be hidden from view, the appearance of the visible portions forms a fairly reliable guide to the workmanship of the unseen portions.

In dealing with the testing of exchange apparatus it has, of course, been necessary to make a selection of the tests to be described but more space could have been found by omitting some of the pages of requirements for telephone relays. It is mentioned that each subscriber's meter is operated 10,000 times on test and that it must not fail once during this test. No doubt it is most desirable that this piece of apparatus should function with absolute reliability, but when it is considered that few subscribers make more than 5,000 calls per annum and that the test therefore represents two years' working life of the meter, the requirement appears to be rather excessive, especially in view of the fact that the meters receive a further rigorous test when they are installed in the exchange.

The chapters on measurements at audio frequencies and the Post Office tests on thermionic valves provide useful information which is not readily available elsewhere.

The work concludes with chapters on telegraph apparatus and the maintenance testing of lines, the latter dealing with the ordinary routine tests and methods of locating faults on overhead and underground cables.

It will be obvious from the foregoing that the work deals with British Post Office practice throughout, but this is no detriment since the standard of excellence in workmanship demanded is certainly as high as, and probably higher than, that of any other telephone administration.

No attempt has been made to deal with the testing of automatic telephone apparatus and it would have been very difficult to make a selection in the present state of the art. Nevertheless, the subject has to be tackled and perhaps we may hope for a companion volume which will deal with this branch of the subject.

One criticism that must be made is that the book is in some parts not sufficiently divided into paragraphs and this renders it difficult to refer quickly to a particular subject.

The text appears to be particularly free from errors and the illustrations are clear and well reproduced. The work forms a valuable addition to the literature of telephone engineering and will be welcomed by all who are engaged in the manufacture and testing of telephone and telegraph apparatus.

Tuning Coils and How to Wind Them. By G. P. Kendall, B.Sc. Pp. 67. Illustrations 46. London: Radio Press, Ltd. Price, 1s. 6d. net.

There are so many tuning coils of various forms on the market that the amateur experimenter is apt to think that it does not much matter what forms he uses in his set, and in so thinking he makes a profound mistake. The use of suitable and efficient coils is, if not half, at any rate a large part of the battle in the construction of a receiving set.

It is, too, a part of the battle in which the home constructor can easily compete with the manufacturer, provided he has a little patience and knows what he wants. Given the patience and this book as a guide he can get what he wants, with pleasure, and with more money available for other parts of his set.

Mr. Kendall discusses the relative advantages of the various forms of tuning coils, and explains clearly how they can be constructed. The possibilities are numerous, and this, indeed, is the only fact in the book that could drive the reader to the shop-made article.

Wireless Sets for Home Constructors. By E. Redpath. Pp. 129. Illustrations 97. London: Radio Press, Ltd. Price, 2s. 6d. net.

This book describes in detail the construction of crystal sets with and without amplifiers, and the following valve sets, *viz.*, Two and Three Valve Broadcast, Three Valve Regenerative, Single Valve Reflex, and Four Valve Universal, the whole arranged in progressive order.

Some of the matter has already been published in *Wireless Weekly*, of which Mr. Redpath is assistant editor.

It is stated in the preface that the sets described are of proved efficiency, a point of great importance to the constructor. The constructional details are well described and amply illustrated, but the reader must not expect to learn here how they work, as it would not be possible to give useful theoretical explanations in a book of this size, covering so much ground.

We should have preferred, indeed, to see circuit diagrams at the beginning instead of at the end of chapters, so that the reader would have before him, from the start, the circuits which he was setting out to construct, and we should

have liked more theoretical explanation, even if the space required would have necessitated the omission of one or two circuits.

Mr. Redpath, however, has gone to work on rather different lines, and the book will, no doubt, prove of considerable value to the ever-increasing army of home constructors.

---

500 Wireless Questions Answered (2nd Edition). By E. Redpath and G. P. Kendall, B.Sc. Pp. 133. Illustrations 39. London: Radio Press, Ltd. Price, 2s. 6d. net.

As the authors of this book are on the editorial staff of the journals issued by the Radio Press, they know what questions are likely to be asked by the amateur experimenter, and they have used their knowledge to good effect.

The questions are admirably arranged for reference by being split up into sections and indexed, but it is really more useful than the ordinary book of reference as it can be read with interest from beginning to end.

The answers are clearly given and aim high, so high, indeed, that many readers will be somewhat surprised that they ever hear anything at all on their own sets. The answer to question 242 to the effect that tonic train is better for "carrying power" than spark, and that there is doubt as to the relative positions in this respect of spark and telephony, seems rather misleading.

But these are small matters; the book is excellent, and can be safely recommended to amateur experimenters and listeners in radio telephony.

Mechanical Stoking. By D. Brownlie, B.Sc.(Lond.). Pp. x+234. Figs. 122. Eight Tables. London: Sir I. Pitman & Sons, Ltd. Price 5s. net.

This little book mainly consists of a comprehensive description of all the various types of coking and sprinkling stokers in general use in this country.

An interesting and instructive chapter is devoted to the history and development of mechanical stoking and smoke prevention appliances, and it is rightly pointed out that the whole of the modern principles of mechanical stoking were understood and applied by the year 1845, when it began to be recognised that in addition to minimising, to a large extent, the amount of black smoke produced, the prospects were good for doing away with the unpleasant work of stoking boilers, and cleaning fires by hand.

In all large boiler plants the mechanical handling of coal before it reaches the boiler is a necessity, and even with comparatively small plants this matter is worthy of serious consideration. Mechanical stoking is particularly suited to the handling of coal and ashes by mechanical means, and this heavy and expensive work can be done more cheaply and more efficiently by many of the modern methods described in the chapter on mechanical coal and ash handling. Typical installations for dealing with coal and ashes are fully described, and cover the ground in a very satisfactory manner.

The last chapter in the book deals with the advantages, disadvantages, and best methods of working mechanical stokers, and one would be led to believe that the claims of firms manufacturing stoking machinery are not altogether reliable, because it points out that hundreds of users have condemned them completely, although at the same time mentions that the same number have found them a great success.

It is of course well known that some particular type of mechanical stoker will give every satisfaction to one firm, whilst the same stoker will be thrown out by another. This is no doubt due entirely to the lack of the skilled attention which these appliances undoubtedly require.

To those who wish for particulars of all the modern British stokers, together with information regarding coal and ash handling plants, this book can be recommended. Although the greater part has been necessarily compiled from catalogues, it is written by an expert on the subject, who has had a very extensive experience with this type of plant, and who has given the right information in a very satisfactory manner.—E. P.

Published Specifications.

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

24,392. "Telephone repeaters." Siemens & Halske Akt. Ges. June 15th, 1922. (199,344.)

24,408. "Telephone repeaters." Siemens & Halske Akt. Ges. June 15th, 1922. (199,345.)

26,304. "Apparatus for the automatic switching on and off of mercury-vapour rectifiers." C. A. A. Haighton. October 1st, 1921. (186,621.)

29,254. "Production of artificial filaments." L. A. Levy. October 26th, 1922. (213,300.)

29,439. "Winding, forming, and like devices for making coils for dynamo-electric machinery." B. Gill. October 28th, 1922. (Addition to 201,586.) (213,301.)

29,476. "Electric telegraph apparatus." F. E. Pernot. October 28th, 1922. (213,302.)

32,421. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd. April 5th, 1922. (195,930.)

32,426. "Radio-signalling systems and apparatus therefor." R. E. H. Carpenter. November 27th, 1922. (213,309.)

34,503. "Prepayment electricity apparatus." Chamberlain & Hookham, Ltd., and S. James. December 18th, 1922. (213,319.)

34,776. "Relays and the like." Barr & Stroud, Ltd., W. Stroud, and J. W. French. December 20th, 1922. (213,320.)

34,953. "Sound-reproducing apparatus." M. Maag. December 31st, 1921. (191,031.)

35,054. "Head-lights of vehicles." J. Ayer. December 23rd, 1922. (213,329.)

35,222. "Impulse transmitters of the dial or like type for use in telephone systems." Automatic Telephone Manufacturing Co., Ltd. December 28th, 1921. (191,054.)

35,223. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. December 24th, 1921. (Addition to 169,698.) (191,055.)

35,440. "Induced-current medical instruments." K. Murakoshi. December 29th, 1922. (213,336.)

35,492. "Ignition apparatus for internal-combustion engines." H. F. Yeowell, E. H. Mills, and W. F. Posser. December 30th, 1922. (213,339.)

35,493. "Electric ignition devices." British Thomson-Houston Co., Ltd., A. P. Young, and E. G. Parrott. December 30th, 1922. (213,340.)

35,504. "Dynamo-electric machines." C. A. Parsons and J. Rosen. December 30th, 1922. (213,341.)

1923.

107. "Sparking plugs." Sir R. A. S. Paget and Thermal Syndicate, Ltd. January 1st, 1923. (213,346.)

112. "Aerial for wireless apparatus." J. H. Cook. January 1st, 1923. (213,347.)

475. "Vacuum tubes of the 'audion' type." F. Peri. October 12th, 1922. (Addition to 205,038.) (205,457.)

1,455. "Relay and coupler mechanism for electric organs and the like." F. P. Walker, R. H. Walker, and J. W. Walker & Sons, Ltd. January 16th, 1923. (213,360.)

1,497. "Searchlights or projectors for motor-cars and other vehicles." W. G. Riley. January 17th, 1923. (213,362.)

3,480. "Joint-chairs for tramway and like rails." J. King & Co. (Leeds), Ltd., and G. E. Stringer. February 6th, 1923. (213,378.)

3,511. "Electric accumulators." T. Armitage. October 29th, 1923. (213,380.)

3,919. "Holders for thermionic tubes." Beswinning's [illegible]m of) and R. E. Beswick. February 9th, 1923. (213,383.)

4,273. "Micro-relays." I. Kajino. February 13th, 1923. (213,386.)

4,502. "Portable apparatus for producing and applying electric currents for therapeutic purposes." C. Firpo. July 24th, 1922. (201,135.)

4,604. "Safety device applicable to wireless apparatus for protecting valve filaments." A. H. Hunt. February 16th, 1923. (213,387.)

5,201. "Smoother or sifter circuits for use with wireless apparatus." Fuller's United Electric Works, Ltd., and A. P. Welch. February 22nd, 1923. (213,395.)

6,979. "Electrical insulators." F. W. Schildt. March 10th, 1923. (213,410.)

7,167. "Electrical conductors for alternating current." T. F. Wall. March 13th, 1923. (213,416.)

7,203. "Automatic and semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and W. Cornell. March 13th, 1923. (213,417.)

9,031. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. April 8th, 1922. (195,964.)

9,489. "Mounting of electric lamp bulbs in vehicle lamps." H. A. Suttie. April 6th, 1923. (213,435.)

9,659. "Selecting switches." Western Electric Co., Ltd. (Western Electric Co. Inc.). April 9th, 1923. (Addition to 197,185.) (213,437.)

9,886. "Systems for the transmission of angular motion." British Thomson-Houston Co., Ltd. June 16th, 1922. (199,357.)

10,675. "Electric radiator." A. Bourgain. May 15th, 1922. (197,663.)

12,171. "System of electric transmission with variable frequency providing for the continuous variation of speed and the reversal of motion." E. Granat. May 24th, 1922. (198,349.)

12,243. "Electric resistance materials." S. Katatani. May 8th, 1922. (197,340.)

12,484. "Portable aerials for wireless signalling." H. F. Holworthy. May 9th, 1923. (213,455.)

12,671. "High energy output electric discharge devices and methods of operating same." Western Electric Co., Ltd. May 12th, 1922. (197,689.)

12,696. "Selecting switches." Western Electric Co., Ltd. (Western Electric Co. Inc.). May 11th, 1923. (Addition to 197,185.) (213,458.)

12,779. "Regulating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. June 14th, 1922. (Addition to 184,278.) (199,368.)

13,140. "Arrangement of charging electric storage batteries." E. Pöhler. May 16th, 1923. (213,460.)

13,250. "Thermionic amplifying valves." A. Garbarini. May 17th, 1923. (213,461.)

13,541. "Electric ignition system for gas burners." E. T. Banzhaf. May 22nd, 1923. (213,463.)

13,967. "Electrolytic separation with fused electrolytes." B. E. F. Rhodin. May 26th, 1922. (198,376.)

15,339. "Sound-wave reproducers." F. P. Habicht. April 13th, 1923. (213,474.)

17,243. "Portable apparatus for producing and applying electric currents for therapeutic purposes." Dr. C. Firpo. July 3rd, 1923. (Addition to 201,135.) (213,483.)

18,448. "Heat control for electric induction furnaces." W. Elsdon-Dew, L. Pryce, and L. B. Woodworth. January 13th, 1923. (209,707.)

18,793. "Electric switches, wall-plugs, and the like." M. J. Railing and J. H. Collings. July 21st, 1923. (213,489.)

22,803. "Electric cells." Metropolitan-Vickers Electrical Co., Ltd. September 27th, 1922. (204,694.)

23,347. "Electrical protective systems for telegraph and telephone circuits." Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1922. (204,699.)

24,139. "Electric motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co.). September 27th, 1923. (213,506.)

26,019. "Electromagnetic switches." Metropolitan-Vickers Electrical Co., Ltd. October 24th, 1922. (206,140.)

29,414. "Radio-receiving systems." British Thomson-Houston Co., Ltd. November 21st, 1922. (207,535.)

29,808. "Electric protective devices." Schweiz Gluhlampenfabrik Akt. Ges. December 26th, 1922. (209,050.)

1924.

1,530. "Mountings or attachments for telephone receivers." H. J. Brookes. March 15th, 1923. (Divided application on 211,722.) (213,519.)

Supplies for the Rumanian General Post Office.—The Commercial Secretary at Bucharest (Mr. Alexander A. Adams) has forwarded to the Department of Overseas Trade a translation of the conditions applicable to all contracts for supplies made by the Rumanian General Post Office. A copy of these conditions can be obtained by United Kingdom firms interested upon application to the Department.